Winter 1989

South Dakota Farm and Home Research

South Dakota State University

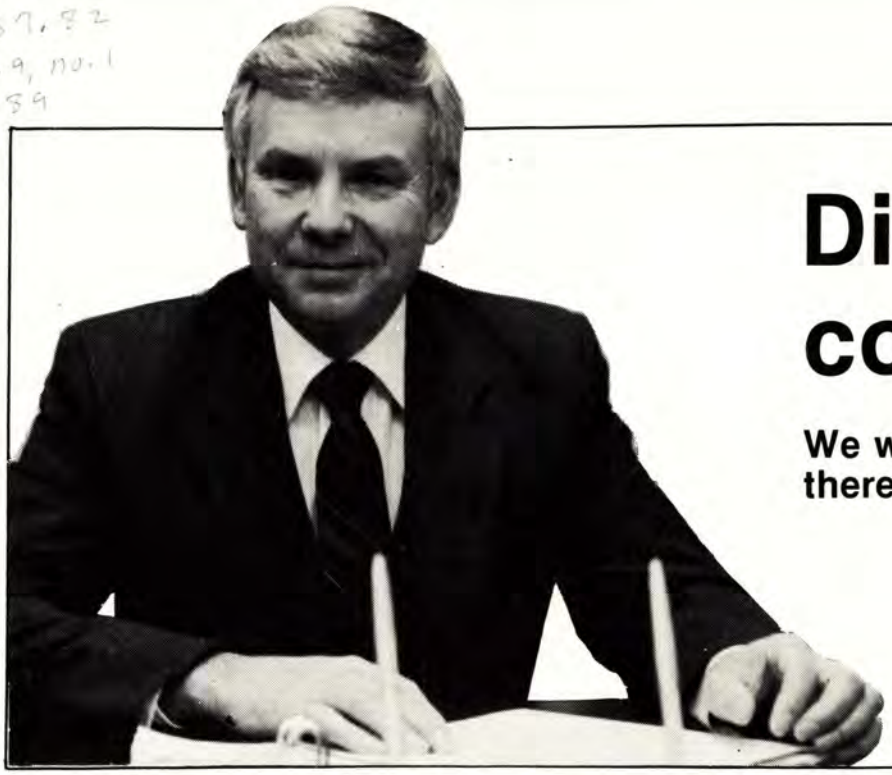
south dakota

farm & home research

vol 39, no 1

Native Americans in South Dakota

page 14



Director's comments

We won't say 'quits,' but there isn't much time left

Ray Moore
Agricultural Experiment Station

My greatest frustration as Director of the SDAES is to receive letters and calls implicating the Ag Experiment Station as a major component in the promotion and use of ag chemicals.

I believe we are no more responsible for this situation than we are for the size of tractors on farms, the size of the farm or ranch, or the price of commodities.

We do not manufacture chemicals or conduct research to develop them. We do evaluate them, and we should. You ask us to do this; you need to know how to use chemicals under our South Dakota conditions.

We are, in a small way, conducting research that would reduce the use of chemicals. The only reason we do so little is because we lack the funds to do more.

We use the dollars you provide to do the things you ask, and this is proper. Not enough of you are asking for research to reduce our use of chemicals. But many of you are concerned; I get a lot of good response when I talk about this at meetings. Someone will always ask, however, "How long before we see results?"

The only honest answer is many years. To develop a crop variety that has its own built-in resistance to pests without sacrificing quality or yield is a challenge. But only a challenge. With the tools of today's biotechnology, sufficient time, and, of course, good scientists who are adequately funded, I firmly believe we could develop such a variety.

Researchers have already developed a corn plant that has nodulated roots like those of legumes. The corn can produce some of its own nitrogen needs. Unfortunately, when it does, it does not have enough energy left to produce a satisfactory ear.

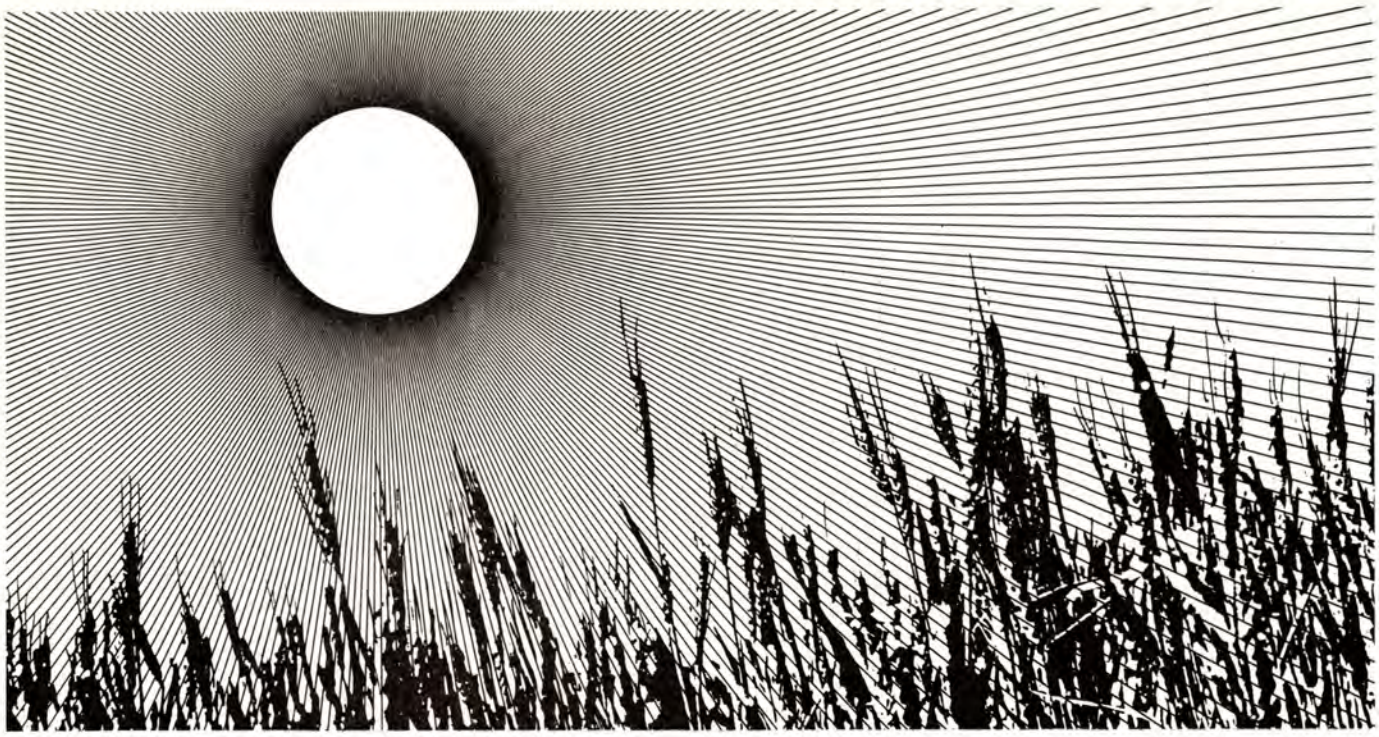
Many give up and say this is the final chapter. I say that it is only the beginning.

I am starting to feel a need for haste in pursuing this goal of reducing our chemical overload. When I look in the mirror, I know that before long, if I don't turn in my keys, someone is going to come looking for them.

There's an even greater urgency. Some private seed companies are now merging with chemical companies. Their purpose is to produce new crop varieties that are "paired up" with one or more chemicals.

Who's to say that someday soon there won't be a seed genetically altered to include herbicide action, or that there won't be seeds encapsulated with a chemical "paste." or that you won't make a "package deal" that includes bags or jugs of certain chemicals specific to only

(Director's comments continued on page 34)



Spring wheat: 'could have been worse'

Modern varieties and better farming methods saved at least a skimpy crop

This is small comfort to spring wheat growers this year: average yields could have been worse.

The record spring wheat yield for South Dakota was in 1984 at 34 bu/A. The record production of 64.5 million bu came in 1985. These records culminated a period of consistent increases of grain yields beginning in the late 1970s.

Then came the drought of 1988.

There were no spectacular yields this year. Sometimes there were no yields. Nevertheless, the year wasn't a total loss. It gave wheat breeders a jump on the next drought that comes along; we had no problem finding the plants in the SDSU breeding plots that tolerated drought. We can combine them with high yielders to develop new varieties for the dry years in the future.

For producers, too, there was something gained this year. The "new" varieties you planted carried you through the 1988 drought in better shape than the spring wheats your fathers grew in their days or even the varieties you used in 1976.

The average yield for spring wheat this year was estimated by the South Dakota Agricultural Statistical Service to be only 12 bu/A with an abandonment of 30%. This is less than half the yield for the 5-year average (1983-1987) when the average yield was 28 bu/A with a 3% abandonment.

Compare that with the drought year of 1934, when spring wheat yields in South Dakota were only 4 bu/A with 96% abandonment.

In 1956, the average yield was 9 bu/A. Twenty years later in 1976, also a notoriously dry year, the average yield was 11 bu/A and the abandonment was 27%.

The 12 bu/A produced this year was disappointing, but it is three times greater than the yields of the 30s and 1.5 times greater than in the 50s drought.

Chris and Marquis couldn't keep up with modern varieties; farming skills helped

Most drought years bring along extremely high temperatures during the growing season, and 1988 was no exception. Spring wheat, in general, is considered drought tolerant, but it is sensitive to high temperatures since it is a cool-season grass. An increase of average air temperature from 65 to 75 degrees F reduces head size of wheat by 22%. In addition, the drought hit the north-central and northeast areas of the state hardest. These are the major spring wheat areas of South Dakota. If you're keeping track and don't include drought itself, that's a double whammy already.

Yet the average yield, poor as it was, was not as bad as in past drought years. An "interactive system," with inputs from several areas of technology, is responsible.

As with most systems, each component will make an individual contribution, but the system will only operate best when all components are utilized. The individual components can be divided into two general categories: (1) improvement of conditions for plant growth and development, and (2) improved varieties.

Weed control has been the leading improvement in cultural practices. Weeds "rob" the crop of moisture, nutrients, and light. The loss of these essential ingredients is important every year; it is critical in drought years.

Fertility management has improved also; a plant with a good nutrient status can withstand stress better. It can also use other inputs with greater efficiency. Other factors are (1) improved equipment for more timely field operating and less harvest loss, (2) better soil moisture conservation, (3) more protection of the crop from diseases and insect pests, and (4) a general improvement in producers' abilities.

The plants themselves take their share of the credit. All we have to do to show that is compare yields from older and newer varieties grown in the same locations in "good" years (1984-1987) and in a "bad" year (1988).

The yields given in Table 1 are from the statewide trial conducted by the Spring Wheat Breeding Project. All varieties were released during the late 70s and 80s with the exception of Chris. As new varieties were developed, older ones were removed from the comparison. For example, Butte was replaced by Butte 86 in 1985.

Be on the lookout for new varieties, says Fred Cholick, SDSU spring wheat breeder. This year has shown us that the percentage increase in yield of modern over older varieties was the same in 1988 as it was in "good" years. Drought will strike again, but technology—better management and new varieties— will help stabilize average yield at a higher level.

Chris, the comparison, is older; it was the leading spring wheat grown in South Dakota during the late 60s and early 70s.

When comparing performance, remember that these yield responses also include improvements in conditions for plant growth and development.

In every year, all the improved varieties produced greater yields than Chris. On average, they yielded 34% more.

This percentage of improvement was relatively constant even though the actual yield varied greatly. On a percentage basis, the increase in yield was approximately the same in the drought year of 1988 as it was in the other 4 years. (In 1984 this increase was 12.4 bu/A, while it was 4.6 bu/A in 1988.)

These results, from trials throughout the spring wheat production area, show us two major things: First, the relative

Table 1. Yield in bushels per acre comparisons from the spring wheat breeding advanced yield trials comparing new and old varieties.

Variety	Origin & Yr. released	Years 1984* –8*–	1985 –8–	1986 –7–	1987 –8–	1988 –7–
Chris	MN 65	37.9	39.4	29.1	32.4	14.0
Butte	ND 77	50.9	—	—	—	—
Marshall	MN 82	48.0	47.1	—	—	—
Guard	SD 83	48.7	48.6	39.0	39.2	18.5
Stoa	ND 84	53.7	49.2	42.6	43.8	19.3
Butte-86	ND 86	—	51.6	44.0	44.2	19.1
Prospect	SD 88	—	—	42.4	44.2	18.2
Average Improved	(bu/A)	50.3	49.1	42.0	42.8	18.8
Improvement	(bu/A)	12.4	9.7	12.9	10.4	4.6
Improvement	**(%)**	**32.7**	**24.7**	**44.3**	**32.2**	**34.3**

*Number of Locations

Table 2. Yield comparisons of new and old varieties grown in eastern South Dakota.

Variety	Origin, yr released	Year 1984 –3*–	1985 –3–	1986 –3–	1987 –3–	1988 –3–
Marquis	Can 1903	34.4	44.1	19.5	24.8	9.9
Chris	MN 65	36.7	48.2	29.0	34.0	15.5
Butte 86	ND 86	54.2	60.4	45.7	46.0	20.3
Stoa	ND 83	—	—	45.2	46.8	21.6
Shield	SD 87	52.8	60.0	—	—	—
Prospect	SD 88	50.8	63.1	47.5	—	—
Average Improved		52.5	61.2	46.1	46.4	21.0
Improvement (bu/A)						
Marquis		18.2	17.1	26.6	21.6	11.1
Chris		15.9	13.0	17.1	12.4	5.5
Improvement (%)						
Marquis		52.9	38.8	136	87.1	112
Chris		43.3	27.0	59.0	36.5	35.5

*Number of Locations

magnitude of increased yields was the same in "good" and "poor" years. Second, production is strongly influenced by environmental factors that are presently beyond our control.

We can make the case even stronger by going farther back in time to pick up and plant the variety Marquis for comparison.

Marquis was released by Canada in the early 1900s. At that time, it was a "breakthrough" variety, and it was the dominant spring wheat for nearly 20 years until the late 1930s.

Comparisons to Marquis (Table 2) show that the improved varieties increased yield by 85%. Again, the consistently higher yields occurred in relatively good and poor growing years.

Averaged over the last 5 years, Chris yielded 6 bu/A more than Marquis, with a range of 2.3 to 9.5 bu/A. During the same time period, the improved varieties averaged nearly 13 bu/A more than Chris, with a range of 6 to 17 bu/A.

To stabilize yield over the years: switch to new varieties, use up-to-date skills

The lesson to be learned? A variety may have served you well in the past, but loyalty to an old friend, if it's only a spring wheat, doesn't bring in the yield. Keep up with the new releases; find one that suits your growing area and your improved cultural practices, and try it on at least a portion of your acreage.

Technology—better management and new varieties—will take us far, but we still have that "unknown" component of the interactive system we talked about before, that component "beyond our control." The environment will always be reflected in yields. Drought will come again, but the components we put into the system and can control will be better. Those components are stabilizing our average yield at higher levels than in the past, in good years and in bad. □

The writer is Fred Cholick, SDSU spring wheat breeder.

Forecast: continued 'infinite variety'

We're just in right spot to be hit from all sides, says Mr. Weatherman

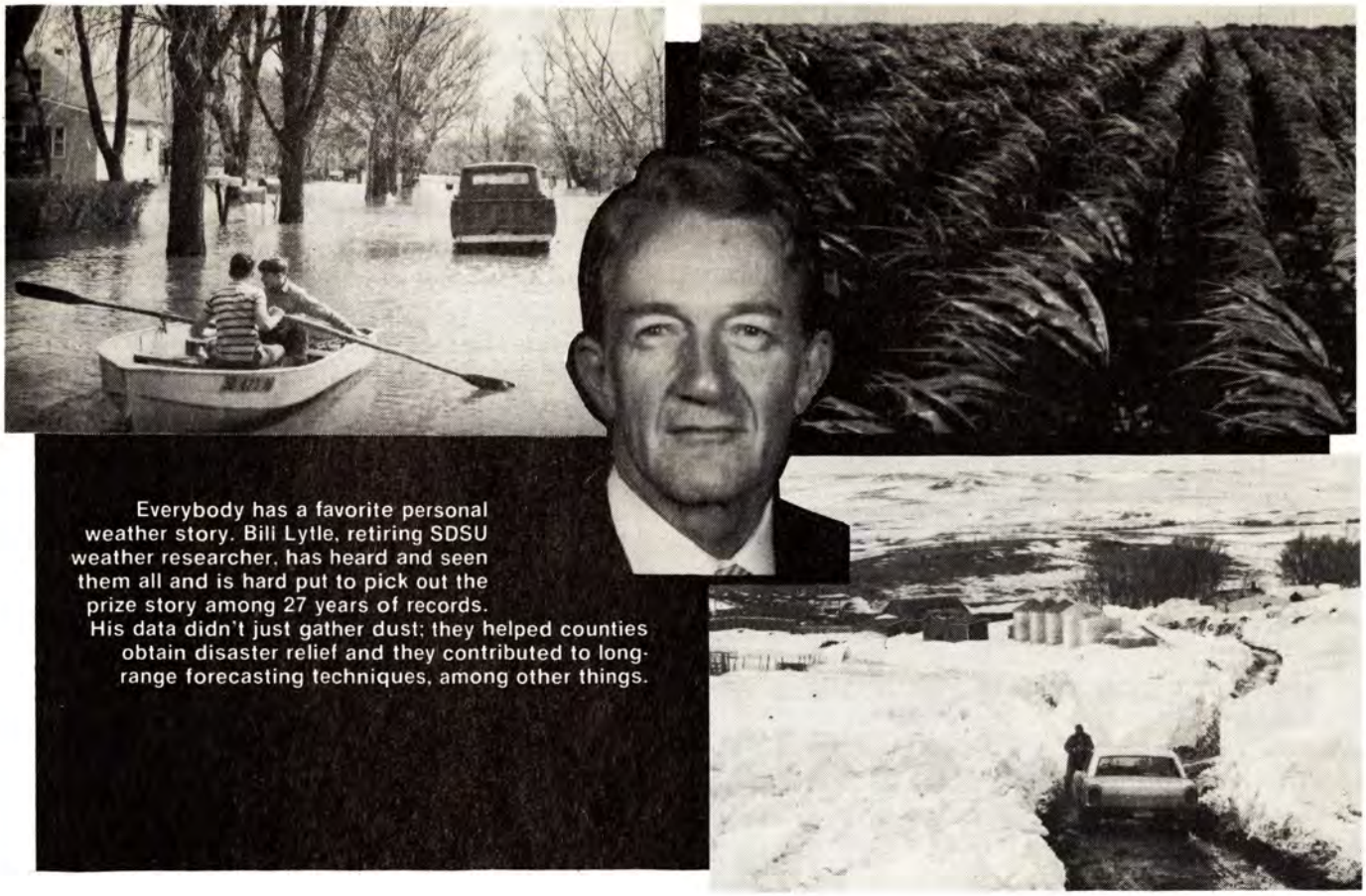
"I've seen some of South Dakota's driest, wettest, and warmest years since the 1930s."

He's not only seen them; he's recorded them. After 27 years at SDSU, Bill Lytle, state climatologist and weather researcher in the Ag Engineering Department, has retired after collecting a roomful (and more) of climatical data records. From them he pulled out a few special years to talk about.

"A lot of weather records have been set in South Dakota within the last decade. The wettest year on record is 1982 when the statewide precipitation average was 25.47 inches."

On the other side of the fence, 1976 was the driest year during Lytle's tenure at SDSU with a statewide precipitation average of 12.88 inches.

"That was the fourth driest year in South Dakota since records began." The 3 years that topped 1976 were in the '30s.



Everybody has a favorite personal weather story. Bill Lytle, retiring SDSU weather researcher, has heard and seen them all and is hard put to pick out the prize story among 27 years of records. His data didn't just gather dust; they helped counties obtain disaster relief and they contributed to long-range forecasting techniques, among other things.

"Last year, 1987, we had the second highest average yearly temperature on record. The year 1931 still holds the record for the warmest year, with an average temperature of 50.1 degrees F," Lytle said.

The hottest temperature ever recorded in South Dakota was 120 degrees F in Gann Valley in 1936. Ironically, the coldest temperature was also recorded in 1936 at minus 56 degrees F in McIntosh.

This year, 1988, didn't make the record books. The 1930s still have it beat, Lytle said.

"In Brookings, for the months of June, July, and August, there were 6 days over 100 degrees and 26 days over 90 degrees." Brookings residents may remember the summer differently, but Lytle has the drop on them—his records are "official." The summer of 1936 topped 1988, with 18 days over 100 degrees and 44 days over 90 degrees.

According to Lytle, July and August of 1988 averaged out to have temperatures very near normal; however, May and June were considerably warmer than normal. The average temperature in May was 5.2 degrees above normal; in June it was 7.5 degrees above normal.

"This year has been dry, but South Dakota has seen worse," Lytle said.

In July, the statewide precipitation average was 1.27 inches, 53% of normal (2.32 inches). "For the entire year to August 30, a statewide sample of precipitation shows 9.87 inches, 79% of the normal 12.46 inches."

"Of course, different areas of the state have been affected differently by the drought," Lytle said. Northeastern and north-central South Dakota experienced extreme drought this year. Most of the rest of the state had severe drought, except south-central South Dakota, which has only had moderate drought.

"The winter of 1969 was the year for snow.

"Brookings recorded 78 inches of snow and Sioux Falls recorded 98 inches. It just couldn't seem to stop coming down.

"When it finally did melt, we had the worst spring floods I've ever seen. The

highest peak in the Big Sioux River at Sioux Falls was four times its normal height," Lytle said.

It's more than reading thermometer twice a day; records help get disaster relief

Record keeping was only part of Lytle's job at SDSU.

"Over the years, my job was to compile weather data, not to make short-term forecasts, but to determine long-term probability."

He supplied the National Weather Service with climatical data since 1973. As a researcher, "I provided climatical data to anyone that needed it, such as county extension offices, ASCS offices, and private businesses."

Counties need accurate climatical data when applying for disaster relief, Lytle said.

Over the years Lytle also provided information for the Department of Water and Natural Resources, the state's Department of Agriculture, and the Statistical Service in Sioux Falls.

At first, "the only type of computer I had stored all of its information on cards. It seemed like I had about a million of those cards around. If I wanted to check some data I had to find the card first."

Collecting the data was only the beginning of Lytle's work. He developed statistical programs for the data, such as correlations between wind directions, barometric pressure, and temperature. He published monthly reports. He shared his methods and analyses with the climatologists of the 13 north-central states.

Before coming to SDSU, Lytle earned bachelor degrees in ag engineering and civil engineering and a master's in civil engineering from the University of Illinois. The Air Force sent him to the University of Chicago to complete training in meteorology.

He spent 5 years in Europe forecasting for the United States Air Force during World War II. After the war he taught and researched at the University of Illinois and Louisiana State University before coming to SDSU.

Just the right position to get hit from all sides with all types of weather'

Lytle taught classes at SDSU in ag engineering, and he feels this helped him keep up with new technology.

"The jet stream did a lot to advance weather technology. They first discovered the jet stream during World War II when bombers ran into some 200 mph head winds, but it took a while to really understand what effect they have on the weather," Lytle said.

"There's a relatively new discovery that is being studied now— the 'El Nino.'"

The El Nino is an increase in ocean water temperature off the coast of Peru. This warm water builds up and heads toward the equator and into the Pacific Ocean, changing the location and strength of high and low pressure areas.

"It's kind of hard to believe that an increase in ocean water temperature along the coast of Peru could eventually affect the weather in South Dakota, but studies seem to be proving it. The changes in the Pacific Ocean currents affect our winds, our high and low pressures, and even our temperatures," Lytle said.

"After 27 years in South Dakota, I've come to the conclusion that our state is definitely an area of infinite weather variety.

"We seem to be in just the right position to get hit from all sides with all types of weather. Low pressures from the Rocky Mountains can cause cold or warm fronts, depending on which direction they turn. A front in Canada can keep the temperature subzero for weeks at a time, or a low from the gulf can bring up moisture."

With his long-term experience in weather analysis, Lytle has been the source for many radio, television, and newspaper stories. When the weather in South Dakota gets even more extreme than usual he's had calls from the AP in New York and Los Angeles.

The calls will keep coming. A man with Lytle's reputation and records doesn't just fade into the sunset at retirement. He'll have his weather eye on those clouds. □

The author is Julie Halverson, SDSU ag news writer.

Dairy Center: a teamwork showcase

One of just six in country leads off with new-product, food-safety research

Product safety and new markets are the two major influences behind the research projects in SDSU's new Dairy Research Center.

The Center, one of six nationwide, is a joint operation of the SDSU Dairy Science Department and the University of Minnesota Department of Food Science and Nutrition.

"The name is appropriate," says John Parsons, head of SDSU's Dairy Science Department, "even though you might have trouble finding the exact physical 'center' in either St. Paul or Brookings."

Two strong departments with different areas of expertise have come together to accomplish what they could not do separately.

"We will be able to meet the real needs of the dairy industry, not only in our region but nationwide, in a way that neither department could have done by itself."

SDSU is nationally known for its dairy technologist training program, and Minnesota for its dairy product research.

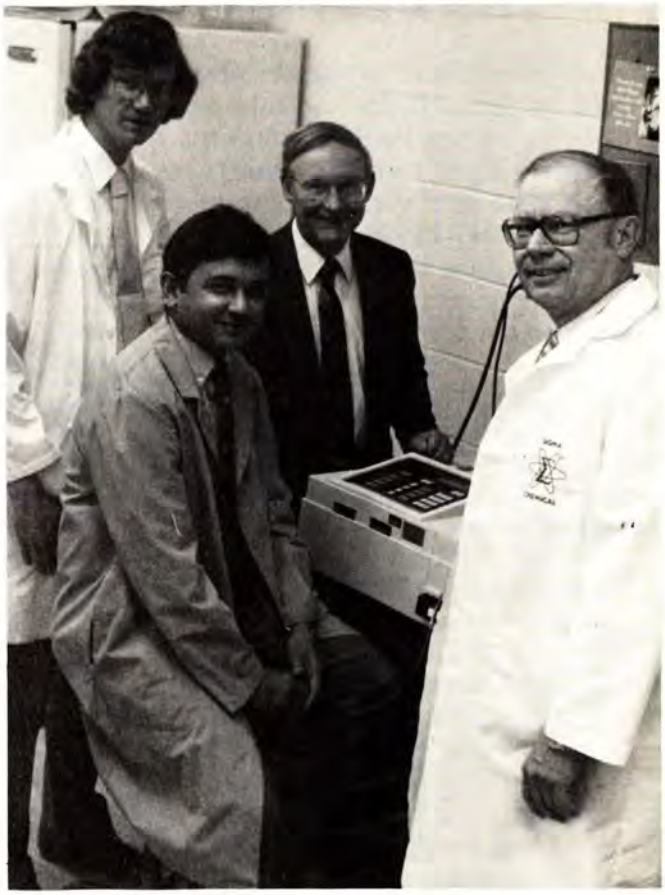
The Dairy Center, officially opened this past summer, is contracted by the USDA and the National Dairy Board. The Center supports the development of new dairy products and new ways of using dairy products.

As an example of things to come from the joint research center, Parsons said, SDSU will test the cheese cultures developed by a Minnesota researcher for flavor, palatability, and acid development in the cheese product.

"We make cheese every day; we know how to do that part of the research," Parsons said. "The cultures were developed with biotechnological techniques which we can't do at present but don't need so long as we can work together.

"A team of horses can plow new ground better than one horse yoked up by itself."

SDSU dairy scientists are also initiating projects. Their prime concern may be product safety, but they are also interested in helping the dairy industry offer attractive new products to consumers.



SDSU dairy scientists Bob Baer, Vikram Mistry, John Parsons, and George Torrey (l to r) are leading researchers in the South Dakota section of the Dairy Center. SDSU's nationally recognized specialty is dairy technology; its partner, the University of Minnesota, is strong in basic research. One principle uniting the diverse projects at SDSU is increased food safety.

Food safety standards are tough but 'there is more to be done'

The multistate salmonellosis outbreak of 1985 and the increasing number of reports of milkborne campylobacteriosis fuel the urgency to detect ever-smaller quantities of pathogenic organisms in ever-larger quantities of milk.

A high-volume dairy combines milks from different suppliers in large silos before processing, writes George Torrey in his project proposal. If milkborne pathogens come in from any supplier, they are diluted in the entire milk supply and become next to impossible to find by current detection methods.

Torrey will develop techniques to uncover low numbers of pathogens in dairy products.

The 1985 salmonellosis outbreak was traced to fluid milk products from an Illinois dairy. Regional milk consumption dropped, and some physicians temporarily restricted dairy product consumption in high-risk groups: infants, the elderly, and patients on certain drug therapy regimens.

Since the outbreak, inspection of raw milk and milk products has become even more stringent, but scientists like Torrey feel there is more to be done.

Although the rate should not cause alarm yet, milkborne outbreaks of

More variety in milk products will attract people to the dairy cases, and SDSU scientists are focusing on techniques that local plants can use without excessive extra investment. The Dairy Center conducts research that supports the development of new dairy products and new ways of using them. Milk ingredients are also part of many of the 400 or so other new foods that reach supermarket shelves every year.

campylobacteriosis have been reported increasingly in the U.S. since 1980. The causative agent is difficult to isolate from refrigerated milk and only recently has been found in milk products susect in an outbreak of campylobacteriosis food poisoning. At present, no detection method is routinely successful. Torrey has included this pathogen in his proposal.

In a related project, Torrey will "gas" milk and retentate from ultra-filtered milk in the hopes of protecting them from spoilage organisms.

Carbon dioxide occurs naturally in cows' milk already. Torrey suspects that more carbon dioxide can be added to fluid milk on the farm before processing and to other liquid, unpasteurized dairy products to control those microorganisms able to grow under refrigeration.

Adding antimicrobic gases produced by the bacterium that processors have already found to inhibit growth of molds on cheeses ought to help reduce losses from mold spoilage.

The influence of the preservative gases on product flavor, color, and other attributes will be monitored throughout the study to assure that gas concentrations do maintain or enhance quality and to evaluate the practicality of the method.

Practical methods being sought to make casein, now totally imported into U.S.

Nearly 400 new food products are added to supermarket shelves every year, and many of them contain milk based ingredients. The meats industry produces approximately two to three trillion pounds of processed meat a year, and milk proteins are part of the ingredients.

One of those milk proteins is casein, and all food-quality casein is imported from New Zealand and a few other countries.

Casein imports have almost doubled in the past 20 years; in 1987, 200 million pounds were brought into the country. The National Commission on Dairy Policy has suggested that casein be reclassified from its current industrial chemical status to that of a dairy product and therefore be subject to import quotas.

That will put heavy demand on local casein/caseinate producing sources, says Vikram Mistry in one of his two related project proposals. At current commercial technology, meeting the demand will require new, specialized, and expensive equipment.

By using exisiting technology in a new manner, Mistry hopes to diafilter skimmilk to 15-20% protein and remove as much salts and lactose as possible. He will then spray dry the precipitate to a 4% moisture powder containing no

lactose and minimally denatured casein and whey proteins.

The process eliminates the need for new equipment in dairy plants, as many already own ultrafiltration systems and spray dryers.

Development of the new products will help open avenues for new food products and increase milk utilization in the U.S., Mistry says.

Reduced saturated fats and calories would draw consumers to milk products

Cheddars are the backbone of the cheese industry, but there are cheddars and cheddars.

Some cheese manufacturers concentrate milk to approximately 15% total solids before beginning the cheese making process. Bob Baer will investigate taking the concentration several points farther.

Condensing the milk will allow cheese makers to make more efficient use of plant equipment, he says, and ease the problems of whey disposal.

Baer and Dave Schingoethe have incorporated dairy-cow feeding into another product manufacturing study.

They remember hearing, in the days when milk stayed on the farm, "boy, you sure could taste when the cows got into the wild mustard in the spring."

Those days are long past, but feed still makes a difference, even if it can't be tasted. The fatty acid composition of milkfat is altered when cows are fed added fat from soybeans, soybean oil, sunflower seeds, or other plant or animal fats.

Milkfat contains about two-thirds saturated fatty acids. Today's health-minded society would like that concentration to be lower.

Very few research studies have evaluated the feeding of added fat or the products from the resulting milk, the scientists report. They expect new and modified low saturated-fat dairy products from their research, which will lead to increased dairy product consumption overall.

Not only is the public increasingly fats conscious; dieters restricting calorie intake have increased in numbers. This means the per capita consumption of ice cream and frozen desserts (with the exception of premium products) is not growing.

Consequently, the dairy processing program at SDSU will add soft-serve ice cream to its already large line of ice creams. Baer and John Parsons will evaluate low calorie sweeteners, bulking agents, fiber, and other new ingredients in the production of low calorie frozen dairy desserts. They will also evaluate commercial frozen yogurts.

The result will be increased consumption and market stimulation as consumers return to milk products.

Studies are supported by South Dakota dairy farmers through checkoff program

"These projects will stimulate the dairy industry in South Dakota and the nation," says Parsons. "We are optimistic that we and the scientists at Minnesota will make a difference.

"And we can enter into these needed studies thanks to the new Dairy Center."

Funding for the Center's $1.2 million annual budget comes from several sources, including South Dakota dairy farmers through the commodity checkoff programs.

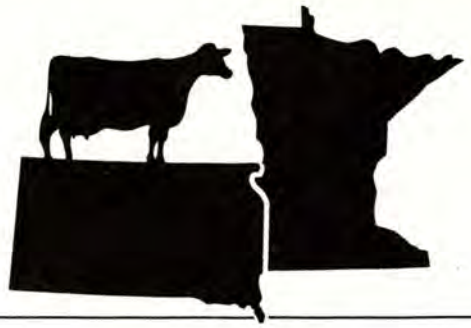
During each of the next 5 years, the National Dairy Promotion and Research Board will contribute $400,000. The Minnesota Dairy Promotion Council ($200,000), the American Dairy Association of South Dakota ($67,370), and various dairy industry groups will add the second third; and the U of Minnesota and SDSU will contribute another $400,000 in matching funds through their experiment stations.

The SDSU Experiment Station will contribute about $100,000 in federal-state matching funds. The local dairy industry, including the ADA, Nordica, Valley Queen Cheese, and smaller groups will add another $100,000. The other third comes from the National Dairy Board. □

Material in this article was collected from John Parsons, head of Dairy Science, and Jerry Leslie, SDSU ag news writer. Information from Sam Brungardt, U of Minnesota writer, was included.

Why here?

Because we've got a success record not many South Dakotans know about



Where is this new Dairy Research Center? We ought to see something for $1.2 million.

Wait a moment, we share that money with the U of Minnesota, says John Parsons, head of the Dairy Science Department at SDSU. Our share is going mostly into hiring researchers and graduate assistants.

For that matter, where's the milk that's produced in this state?

Gone, most of it. Eighty percent is shipped out, says Parsons.

Just like the department's dairy manufacturing graduates. SDSU has the largest dairy manufacturing program in the U.S. and turns out 80% of the country's dairy manufacturing grads every year.

"With the national demand twice the supply of grads, they can go where the money is."

Well, then, if most of our milk and our graduates leave the state, how come we got the additional funds for dairy product research?

Parsons' reply is that the Dairy Science Department at SDSU has made a greater impact outside the state than it has at home.

"Our department, particularly the dairy manufacturing program, is respected nationally. The request that we and Minnesota presented was the model against which the proposals from 25 other institutions were compared."

Those are a couple of the reasons the National Dairy Board awarded $1.2 million to SDSU and the U of Minnesota to jointly operate the Dairy Foods Research Center, one of only six centers nationwide that will conduct basic research to support the development of new dairy products and new ways of using dairy products.

The homefolks would still like to know how the Dairy Center will benefit South Dakotans.

"Practical, efficient ways to make manufactured dairy products safer and more attractive to consumers and increase sales will benefit South Dakota dairymen and the state ag economy," Parsons answers.

"We consume only a fraction of what we produce. The rest is shipped out of state, mostly as cheese products.

"We compete with the rest of the country's dairy producers for the consumer's dollar, so when our research here raises consumer demand, we will profit just as much as producers in California or New Jersey."

In addition, the Dairy Center will benefit local producers because it will be a source of even more information than it is presently.

"We are already answering questions for dairymen from North Dakota and beyond," Parsons said. "For them we are the closest source."

The additional research projects will also draw more students and make it easier to hire faculty. SDSU is the only university in the upper Midwest with a traditional manufacturing program and one of four universities in the U.S. with a traditional dairy science department. (The three others are Mississippi State, Cal Poly, and Vermont.)

Parsons praises the students already enrolled.

At the most recent student intercollegiate contest, a "regional" which included Penn State and Cal Poly, SDSU's three-person dairy products judging team took two firsts, two seconds, and two thirds, top individual, and first overall.

"The second place team, Minnesota, had twice as many points." (Low score wins.)

"Over the years, the dairy products judging teams have won more national contests than any other school in the nation."

These are young people who "come to school thinking dairy is only milking the cows. They find we can offer them scholarships and part-time jobs in our processing plant while they're in college, and that there is demand for their skills after they graduate."

The scholarships get better all the time. The National Dairy Promotion and Research Board offered, this year for the first time, 20 scholarships in dairy manufacturing. SDSU got four of the 20.

"Students who work in the Dairy Center will have a greater edge and command better salaries in the job market.

"It's a good deal all around." □

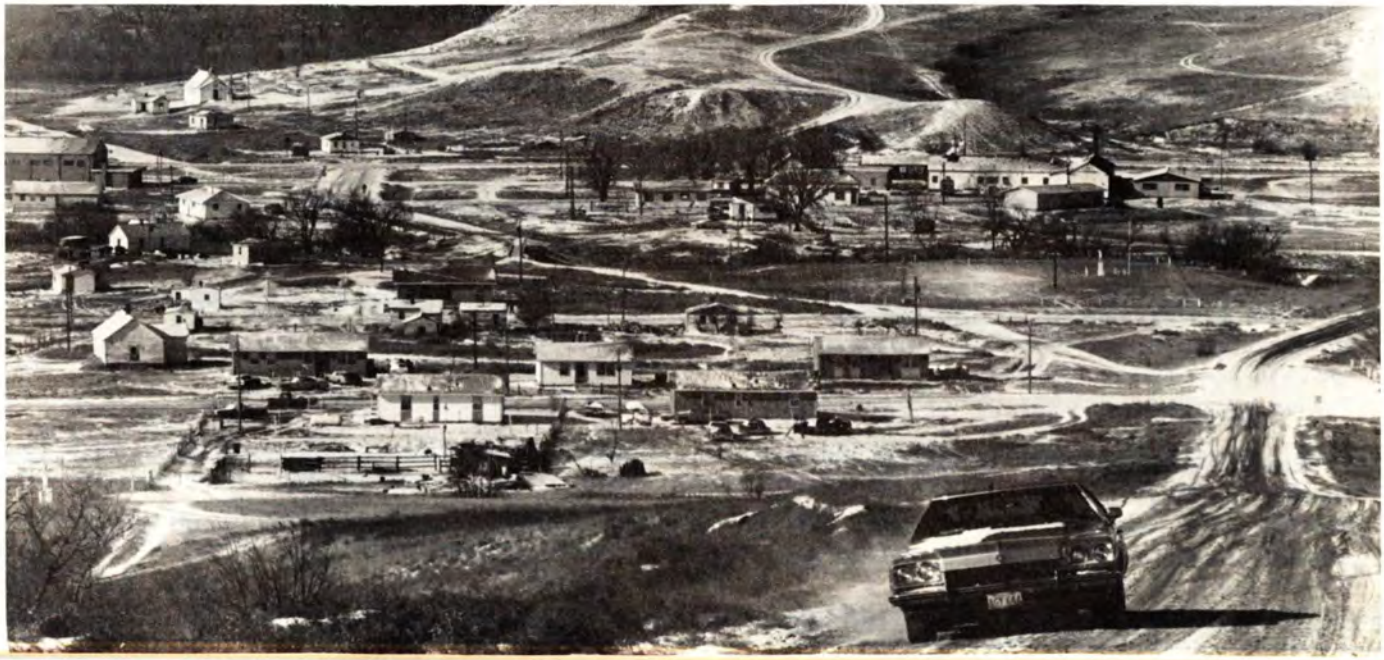
Reservations: basis for development

New projects need most recent, accurate data before start-up

If given a choice, most people would probably pick a good, secure job first and a place to live second.

Native Americans in South Dakota make a different choice. They see themselves first as members of their communities and second as wage earners.

"Family" is paramount in the Native American culture, so much so that many Native Americans will choose to live in communities where job opportunities are lacking. They endure poverty, poor housing, unemployment, underemployment, and inadequate health



care on South Dakota reservations and designated areas as a result.

Tribal governments continue to seek economic and human development to overcome these social conditions. Economic development is not new; many projects have been started on the reservations, only to fail.

Native Americans are actually caught in the backwash of economic development. Even when they accept the objectives of (1) maximum economic self-sufficiency, (2) full participation in American life, and (3) equal citizenship privileges and responsibilities, they still must overcome many obstacles before these objectives become reality.

A competent "change agent" considering services or a new industry anywhere, on or off a reservation, would base the project on the most recent and accurate socio-economic and demographic data available. Data would include general population characteristics, including age composition and residency patterns; social characteristics of households and families, such as education, health, labor force participation, income, and poverty data; and the types of industries already located in the area.

Reservation populations are young, influencing needs in education, jobs

Of South Dakota's nearly 45,000 Native Americans (Dakota), 63% live on nine designated reservations and areas: Cheyenne River, Crow Creek, Flandreau, Lower Brule, Pine Ridge, Rosebud, Sisseton, Standing Rock, and Yankton. Flandreau, Sisseton, and Yankton are open reservation areas (they have no federally recognized boundaries).

Of the 16,480 Native Americans living off reservations, 46% live in just five counties: Bennett, Mellette, and Pennington (all near Pine Ridge and Rosebud), and Brown (Aberdeen) and Minnehaha (Sioux Falls).

Age and sex data reveal the people most in need of those services to which development should be directed.

Reservation populations are young; over half of the people on each reservation is under 20 years of age. In comparison, 32% of the U.S. and 34% of South Dakota's populations are under 20.

Median age (half the population above and half below) ranges from 17.4 years on Crow Creek to 18.9 on Yankton; the median age for South Dakota as a whole is 28.8, while the U.S. figure is 30.0 years.

Lower numbers of elderly accompany the high numbers of young people. The range is from a low of 4.7% elderly in Lower Brule to 9.5% in Sisseton and Flandreau. The percents of aged South Dakotans and Americans, in comparison, are 17.7% and 15.7%, respectively.

Consequently, Native American populations concentrate their resources on services needed by the young.

Family size ranges from 4 to 5.6 people per household; however, children in 45.6% of Native American families live in a single-parent home. The state average is 12.9%.

Single-parent families range from 36.6% of total families at Flandreau to 59.8% at Yankton.

The types of economic development projects initiated on a reservation must be compatible with the skills and work experiences of the population. In most cases, more than 50% of Native Americans on reservations who are 25 or older have not graduated from high school. For all South Dakotans 25 and older, the figure is 67.9% high school graduates.

The reservation percentages probably will not increase without human development programs designed for the young. Less than 53% of all youth from 5 to 19 on the reservations are now enrolled in school. Although statewide figures are available for only 5- to 17-year-olds, 93.3% are in school.

Even 'lowest' reservation unemployment rate is twice the national average

Pockets of underdevelopment and abject poverty exist in the U.S.; Indian reservations in South Dakota are among the most distressed of these pockets.

Based on per capita income, South Dakota reservation counties—Buffalo ($2,642), Corson ($3,563), Shannon

($2,645), Todd ($3,159), and Ziebach ($3,042)—are the poorest in the nation.

Median income is also a measure of the status of Native Americans. Census figures show median family income for the United States at $21,023 and for South Dakota at $15,993. Median income of families on South Dakota reservations ranged from a high of $12,484 at Lower Brule to a low of $6,985 on Standing Rock.

The percentage of persons in poverty ranges from a high of 58% at Pine Ridge to a low of 24% at Flandreau. This figure is determined by median income and family size. Based on the U.S. standard (an income of $9,287 for a family of four), 11.2% of the U.S. and 16.9% of South Dakota people were below poverty level.

High poverty rates and low incomes are also naturally related to unemployment. Reservation communities have extremely high rates of unemployment, from 45.8% at Crow Creek to a low of 28.7% at Rosebud. This compares to 13% for Native Americans nationally.

Native American labor force is concentrated in two industries

By definition, "labor force" includes both working and unemployed people over 16 years of age. The labor force on South Dakota reservations ranged from 82.% at Flandreau to 56.2% of the Yankton population. Of the total South Dakota Native American labor force, 75% is concentrated in only two industries: services (41.3%) and public administration (34.1%). Only 8.4% were in agriculture. Off-reservation work employs 24%.

This reflects the general absence of job opportunities other than those associated with education, social services, and BIA activities. It also reflects the general absence of profit-generating businesses: finance, wholesale and retail trade, and manufacturing.

The lack of retail trade activities has further consequences. Without grocery, hardware, and other stores, Native Americans end up spending their incomes in off-reservation communities, supporting those economies instead of their own.

New jobs won't be enough; human resource development programs will also be needed

Economic development alone won't turn the reservations around.

Development projects must deal also with the Native American society and with social conditions that have been neglected by whites and Native Americans alike for years. Developers must plan for a very young population, large households, a large percent of families headed by a single parent, and low education. There are few job opportunities and, as a result, low median incomes. Poverty leads directly to the serious social problems of high alcohol and drug abuse, poor housing, and poor health.

Project leaders can not take for granted that certain human resources, skills, and abilities already exist. A development project on a reservation that is merely "economic" will probably fail. What has to be built in is a human resource development component.

This component has three options. First is rehabilitation. Increasing personal skills and improving the local infrastructure—sewage and water systems, roads, bridges, and hospitals—are part of this component.

Second are activities which prevent negative economic conditions, including minimum wage laws, improved education for the young, or relocating people to where the jobs are.

Third is a "safety net." Traditional federal programs, such as foodstamps/commodities, Aid to Dependent Children, General Assistance, HUD, CETA, and other programs have helped but they have not altered the basic economy. These programs alone have never raised the standard of living in any part of the country.

Scaled industrialization, the development of mainstreet economies on the reservations, diversification, relevant training and education, and the support of those strong family ties will be an effective economic development package program for South Dakota reservations. □

The writers are Linda Baer, professor, and Don Arwood and Velva-Lu Spencer, graduate research assistants, from the Department of Rural Sociology, SDSU.

The connection

A network forms; SDSU and Ford Foundation help

Native American leaders and college officials, some of them alums, wondered if SDSU could help them.

These community leaders believed that increased training and education in agriculture and natural resource management would open the doorway to economic development on Native American reservations.

The idea sounded just as good in New York as it did in Brookings.

The Ford Foundation of New York, a private funding agency, awarded SDSU nearly $120,000 for 2 years to examine the possibilities. Among other things, the money has supported an advisory board of tribal chair people, planning officials, and community college staff and administrators. It has financed four graduate assistantships connected with the project. And publications bulge with data on the human and natural resource potential of the reservations.

With the backing of the Foundation and the research and teaching support of SDSU, the Native American leaders have been able to enhance programs that could ultimately lead to permanent economic development on the reservations.

They have moved past "beginnings."

After testing a new course offering at Oglala Lakota College under project funding, administrators of the college sought and were awarded a $50,000 grant directly from Ford to strengthen the natural resources curriculum.

The school currently has 20 students enrolled in the curriculum, and all have been placed into summer jobs both on and off the reservation.

Projects reveal the untapped talent and resources found in communities

"SDSU is involved because it is our goal to support South Dakota's Native American population, about 44,000 people, in their move toward economic development and alleviation of poverty," said Linda Baer, project director and associate professor in the Rural Sociology Department.

"The advisory board wanted a database that showed what existed on the nine reservations in terms of human and natural resource potential. We were able to build that for them."

A curriculum in water resource management at Sinte Gleska College, Rosebud Reservation, is being developed

with assistance from SDSU. Ford Foundation helped to sponsor a regional water resource seminar and contributed to the college's purchase of library materials on the issues.

Rosebud sits on the Oglala Aquifer, the largest in the U.S. In addition, tributaries of the Missouri River flow through the reservation. The plan is to train Indian water specialists to assume leadership roles on the reservation, negotiate tribal water rights, and develop long-range plans for water use.

Two other projects, with the Cheyenne River and Standing Rock community colleges, involve the development of an agriculture curriculum and, on the Cheyenne River Reservation, a brochure profiling industrial and business opportunities on the reservation.

The Cheyenne River Community College has already held a 12-week course in "Practical Range Management" to both promote better range management on private and Indian trust lands in the area and "to show Native Americans that there really are employment opportunities in natural resources for trained people."

A second course is planned. If interest remains high, Baer said, the college will expand its agricultural section to a 2-year degree program. Credits are transferrable to SDSU for a 4-year degree.

Cooperative undergraduate post-secondary education programs are being put together at Oglala Lakota College. A 4-week course has already been offered in natural resources.

A unique opportunity is developing with Standing Rock Reservation and the state of South Dakota, Baer said.

The Standing Rock Sioux Tribe is caretaker for over 2.3 million acres in both North and South Dakota. The Missouri River is on its eastern boundary.

"The River as a recreational resource has been virtually untapped to this point because there was no development plan," Baer said.

"Now, however, the South Dakota Department of Tourism and Economic Development and the Army Corps of Engineers are interested in working with the tribe." A consultant has been hired by the state to determine the feasibility of water and recreation development, she added.

'Network' allows cooperation but keeps family and community identities intact

Reservation-based community colleges have been offering adult and post-secondary programs for 15 years to meet the educational and cultural needs of Native Americans.

"Our present projects are building on those successes. They were necessary steps before moving into tribal economic development," Baer said.

"We'd like to establish more permanent institutional links with tribal colleges so that the strengths and expertise of SDSU can be expanded and made available to the reservations. At the same time, we recognize the strengths and resources of the reservations and hope to learn more about the Lakota culture and their understanding of working on and living off the land."

In the meantime, the grants have enabled SDSU to help build a network among tribal planning offices, tribal administrators, and Indian community colleges, the three main entities involved in developing human and natural resources on the reservations.

"Skills and resources, projects, and people transfer along this network," Baer said. "Communities and families retain their identities, but now they are developing wider goals on their own terms and cooperating with each other more fully.

"The people at Ford Foundation have been impressed enough with the spirit and progress of the people involved in this project to continue and increase the funding.

"It is good to have the support of the Ford Foundation. It is even better when more links to to foundations are forged directly by Native Americans to expand and enhance the programs that will train some of the future leaders of the reservations of South Dakota." □

This article includes information from University Relations, SDSU.

101st

ANNUAL REPORT

101st

ANNUAL REPORT

Agricultural Experiment Station

South Dakota State University

Advisory groups

ABS Advisory Committee

1985
Harold Hurlbert, Raymond
Dennis Yeaton, Chamberlain
Charles Johnson, Madison
Lawrence Kocer, Martin
Keith Thompson, Letcher
1986
Michael Stahly, Cavour
Larry Jorgenson, Trent
H. Victor Joachin, Corona
Gary Myers, Onida
Gary P. Gilbert, Ludlow
1987
Ken Brockel, Java
Wayne Heckathorn, Elk Point
Roger Hofman, Clear Lake
Milton Klein, Valentine, NE
Mrs. Wayne (Beverly) Wright, Turton
1988
Harold Arnold, McIntosh
Terry Beastrom, Pierre
Gale Erickson, Gayville
Gary Schwartz, Oldham
Mrs. Dean (Kay) Snyder, Piedmont

Board of Regents

Bonnie Bostic, Sioux Falls
David Christensen, student regent, Vermillion
Max Gruenwald, Milbank
Kay Jorgensen, vice president, Spearfish
Pat Lebrun, Rapid City
George E. Maas, secretary, Watertown
Roger Prunty, Brookings
Dr. Roger Shinnes, executive director, Pierre
E. Steeves Smith, Mitchell
John "Matt" Sutton, Agar
Michelle Tapken, Yankton

Executive

R.T. Wagner, PhD, president
D.A. Bryant, PhD, dean
R.A. Moore, PhD, director and associate dean

Station Statistician

W.L. Tucker, PhD, professor

Fiscal Officer

D.G. Longieliere

Antelope Range Livestock Station

John Brown, Buffalo
Bill Clanton, Buffalo
Blain Drageset, Isabel
Dave Fischbach, Faith
Gary Gilbert, Ludlow
Donn Hett, Buffalo
Clyde Jesfjeld, Prairie City
John Johnson, Piedmont
Mark Keffeler, Sturgis
N. F. "Red" Lyons, Meadow
Ray Meyer, Sorum
Leonard Nygaard, Gascoyne, ND
Larry Vroman, Buffalo

Central Research Station

Brad Bonhorst, Pierre
Lawrence Carson, Wessington Springs
Gail Dobbs Tidemann, Brookings
Dick Fadgen, Huron
Ron Frederick, Highmore
Val Goetz, Onaka
Randy Hague, Highmore
Maurice Horton, Brookings
Scott Ingel, Cavour
Jeff Lounsberry, Miller
Doug Marsh, Onida
Robert Sorensen, Wessington Springs
Ted Swanson, Gettysburg
Reno Veskrna, St. Lawrence
Jake Vilhauer, Highmore
Mike Volek, Highmore
Paul Weeldreyer, Pierre
Ken Wonnenberg, Pierre

Cottonwood

Ohmer Cook, Philip
Clifford Fees, Philip
Eugene Thomas, Murdo
Neal Brunskill, Philip
Larry Gabriel, Cottonwood
Ingebert Fauske, Wall
Richard Kjerstad, Quinn
J. Tipps Hamilton, Ft. Pierre
Rick Horton, Wall
Scott Kennedy, Philip
Jay Crowser, Philip
Bill Headlee, Kadoka
Jerry Jasmer, Philip

Northeast Research Farm

Gail Dobbs Tidemann, Brookings
Lynn Eberhart, Britton
Loyal Evjen, South Shore
Randy Fredrick, Hayti
Donald Guthmiller, Hayti
Harlan Haugen, Wallace
Maurice Horton, Brookings
Orrin Korth, Watertown
Edwin Krause, Clear Lake
Lyle Kriesel, Summit
Chuck Langner, Clark
Robert Lutkemeier, Wilmot
Joe Schuch, Sisseton
Bob Schurrer, Watertown
James Smolik, Brookings
Nate Thompson, Milbank
Lorne Tilberg, Britton
Dale Wiitala, Clear Lake
Jim Wilson, Webster
Mike Johnson, Pierpont

SESD Research Farm

Sidney Abild, Wakonda
Robert Anderson, Hudson
Wayne Burkhart, Dell Rapids
Darrell A. Edelman, Menno
Willie Heubner, Akron
Leon Jorgenson, Freeman
Ron Larsen, Beresford
John Ludens, Davis
John Olbertson, Beresford
Frank Orr, Meckling
Merlin Peterson, Irene
Merlin Pietz, Parker
Craig Rosenberg, Sioux Falls
Merlyn Smeenk, Harrisburg
Joe Uherka, Wagner

Staff

Agricultural Communications

L.K. Tennyson, Ed.D, associate professor and acting head
M.R. Brashier, MS, assistant professor, publications
J.R. Leslie, BS, instructor, ag news and features

Agricultural Engineering

M.A. Hellickson, PhD, professor and head
R. Alcock, PhD, assistant professor
G.A. Anderson, PhD, assistant professor
S.T. Chu, PhD, professor
D.W. DeBoer, PhD, professor
D.P. Froehlich, PhD, associate professor
J.L. Julson, MS, assistant professor
V.C. Kelley, MS, assistant professor
T.M. Klosterman, BS, Farm Supt. Res.
M.A. Schipull, MS, assistant professor
K.W. Stange, MS, assistant professor
H.D. Werner, PhD, associate professor

Animal and Range Sciences

R.C. Wahlstrom, PhD, professor and acting head
A.J. Bjugstad, PhD, adjunct professor
W.J. Costello, PhD, professor
D.D. Dearborn, PhD, professor
R.J. Emerick, PhD, adjunct professor
C.Faller, BS, manager, sheep unit
F.R. Gartner, PhD, professor and director, West River Agricultural Research and Extension Center
D.H. Gee, PhD, professor
R.H. Haigh, BS, manager, beef unit
R.H. Haas, PhD, adjunct professor
C.L. Johnson, BS, research assistant
J.R. Johnson, PhD, professor
P.S. Johnson, PhD, assistant professor
S. Hansen, MS, manager, beef breeding unit
G.W. Libal, PhD, professor
D.M. Marshall, PhD, assistant professor
D.C. McFarland, PhD, assistant professor
H.L. Miller, PhD, associate professor
J.A. Cantrell, MS, supt, Cottonwood Range & Livestock Research Station
R.H. Pritchard, PhD, assistant professor
R.J. Pruitt, PhD, assistant professor
M.M. Robbins, BS, mgr, nutrition unit
J.R. Romans, PhD, professor
A.F. Schlundt, PhD, assistant professor
A.L. Slyter, PhD, professor
R.H. Swan, BS, supt, Antelope Range Livestock Station, Buffalo
J.J. Wagner, PhD, assistant professor

Biology

C.R. McMullen, PhD, professor and head
C.H. Chen, PhD, professor
N.H. Granholm, PhD, professor

Dairy Science

J.G. Parsons, PhD, professor and head
R.J. Baer, PhD, associate professor
D.P. Casper, MS, research assistant
F.C. Ludens, BS, instr/manager, Dairy Farm
V.V. Mistry, PhD, assistant professor
D.J. Schingoethe, PhD, professor
S.W. Seas, MS, professor
J.L. Sommerfeldt, PhD, assistant professor
G.S. Torrey, PhD, assistant professor

Economics

A.A. Lundeen, PhD, professor and head
T.L. Dobbs, PhD, professor
W.D. Ellingson, BS, instructor
L.L. Janssen, PhD, associate professor
C.E. Lamberton, PhD, professor
B.H. Schmiesing, PhD, associate professor
D.C. Taylor, PhD, professor

Home Economics

E.P. Anderson, PhD, professor and dean
M.G. Crews, PhD, associate professor and head
F.A. Bohannon, PhD, assistant professor
L.A. Hallberg, MS, instructor
P.G. Krishnan, MS, instructor

Horticulture, Forestry, Landscape & Parks

T.D. Warner, PhD, associate professor and head
M.E. Enevoldsen, MS, assistant in
N.P. Evers, BS, instructor
P.D. Prashar, PhD, professor
P.R. Schaefer, PhD, assistant professor
P.L. Spinksi, PhD, assistant professor

Microbiology

R.L. Todd, PhD, professor and head
W.R. Gibbons, PhD, assistant professor
R.P. Hillam, PhD, professor
R.M. Pengra, PhD, professor
C.A. Westby, PhD, professor
H.Westfall, PhD, assistant professor

Plant Science

M.L. Horton, PhD, professor and head
W.E. Arnold, PhD, professor
D.L. Beck, PhD, assistant professor, supt, James Valley Research & Extension Center
G.R. Benoit, PhD, adjunct professor (USDA/ARS)
A.A. Boe, PhD, associate professor
J.L. Bonnemann, MS, assistant professor
R.A. Bohls, MS, research associate
T.F. Branson, PhD, adjunct associate professor (USDA/ARS)
G.W. Buchenau, PhD, professor
C.H. Butterfield, MS, research associate
C.G. Carlson, PhD, assistant professor
M.L. Carson, PhD, associate professor
F.A. Cholick, PhD, associate professor
C.D. Dybing, PhD, adjunct professor (USDA/ARS)
E.R. Easton, PhD, associate professor
N.C. Elliott, PhD, adjunct assistant professor (USDA/ARS)
A.M. Espinasse, DAG, adjunct research associate
P.D. Evenson, MS, associate professor
B.G. Farber, MS, research associate, mgr, Central Research Station
M.W. Ferguson, PhD, associate professor
J.R. Fisher, PhD, adjunct assistant professor (USDA/ARS)
P.E. Fixen, PhD, associate professor
B.W. Fuller, PhD, research associate
D.J. Gallenberg, PhD, assistant professor
H.A. Geise, MS, assistant professor
R.H. Gelderman, PhD, mgr, Soil and Plant Analytical Lab
J.L. Gellner, PhD, assistant professor
K.A. Grady, MS, research associate
M.E. Gray, PhD, research associate
R.D. Gustin, PhD, adjunct assistant professor (USDA/ARS)
T.J. Gutormson, MS, instructor
G.L. Hein, PhD, research associate
G.R. Hoffman, PhD, adjunct professor, Biology, USD, Vermillion
J.A. Ingemansen, MS, manager, Foundation Seed Stocks
B.E. Jacobson, BS, assistant in
D.G. Kenefick, PhD, professor
R.W. Keickhefer, PhD, adjunct professor (USDA/ARS)
K.D. Kephart, PhD, assistant professor
R.L. Kepner, PhD, research associate
R.A. Kohl, PhD, professor
D.R. Lance, PhD, adjunct assistant professor (USDA/ARS)
B.E. Lawrensen, BS, agronomist, SESD Research Farm
C.L. Lay, PhD., professor
G.D. Lemme, PhD, associate professor
M.J. Lindstrom PhD, adjunct associate professor (USDA/ARS)
D.D. Malo, PhD, professor
B. McDaniel, PhD, professor
A.E. Olness, PhD, adjunct associate professor (USDA/ARS)
R.J. Pollmann, MEd, assistant professor
M.A. Quinn, PhD, research associate
D.L. Reeves, PhD, professor
D.H. Rickerl, PhD, assistant professor
W.E. Riedell, PhD, adjunct assistant professor (USDA/ARS)
T.E. Schumacher, PhD, assistant professor
J.D. Smolik, PhD, associate professor
D.R. Sorensen, MS, instructor, mgr, SESD Research Farm
C.E. Stymiest, MS, assistant professor
G.R. Sutter, PhD, adjunct professor and director (USDA/ARS)
D.A. Vos, BS, research assistant
D.D. Walgenbach, PhD, professor
T. Wang, PhD, research associate
E.M. White, PhD, professor
Z.W. Wicks, PhD, associate professor

Rural Sociology

J. L. Satterlee, PhD, professor and head

Station Biochemistry

D.C. Hilderbrand, PhD, professor and head
R.S. Baer, BS, research assistant
R.J. Emerick, PhD, professor
D.P. Evenson, PhD, professor
J.E. Houglum, PhD, associate professor
K.R. Howard, BS, research assistant
W.P. Jensen, PhD, professor
L.K. Jost, MS, research assistant
M.S. Kosco, PhD, research associate
I.S. Palmer, PhD, professor
N.J. Thiex, MS, assistant professor
T.P. West, PhD, associate professor

Veterinary Science

D.D. Johnson, DVM, PhD, professor and acting head
C.Y. Andraos, MD, instructor
D.A. Benfield, PhD, associate professor
B.M. Carlson, BA, research assistant
L.R. Fawcett, BS, research assistant
D.F. Francis, PhD, associate professor
G.D. Hanson, BS, livestock supervisor
B.H. Janke, DVM, PhD, assistant professor
C.A. Kirkbride, DVM, PhD, professor
M.C. Libal, DVM, MS, associate professor
D.T. Nelson, DVM, MS, professor
E.A. Nelson, MA, instructor
I.J. Stotz, MS, instructor
M.L. Vickers, PhD, associate professor
S.L. White Hawk, BS, research assistant
S.K. Wynia, BS, research assistant

Wildlife and Fisheries Sciences

C.G. Scalet, PhD, professor and head
C.R. Berry, PhD, adjunct associate professor
A.J. Bjugstad, PhD, adjunct professor
L.D. Flake, PhD, professor
K.F. Higgins, PhD, adjunct assistant professor
K.J. Jenkins, PhD, assistant professor
K.D. Keenlyne, PhD, adjunct assistant professor
D.W. Uresk, PhD, adjunct associate professor
D.W. Willis, PhD, assistant professor

Projects

Agricultural Engineering

H-045—Heat pumps for livestock building heating and cooling and for agricultural processing; Julson, Lytle, Froehlich
H-085—New approaches to tillage practices and equipment design; Alcock, Froehlich, Arnold
H-134—Improvements in farm chore vehicles and their uses; Christianson, Alcock
H-176—Irrigation management for efficient crop water use; DeBoer, Chu, Stange, Werner
H-187—Conservation of water, soil,and energy by constant hold spacing trail tubes; Chu, DeBoer
H-196—Management of shallow water tables under agricultural lands; DeBoer, Chu, Lytle, Stange
H-197—Engineering investigations of animal housing environments; Froehlich, Anderson, Hellickson, Julson, Schipull
H-207—Engineering aspects of mushroom production in the upper midwest; Julson, Foehlich, Pohl
R-214—Weather and climate research for agricultural decision-making in the North-Central Region; Lytle
H-246—Equipment for agricultural operations as related to soil compaction; Froehlich, Alcock
H-247—Evaluation and design of post frame agricultural structures; Anderson, Froehlich, Julson
H-256—Evaluation and design of chemical application equipment for agronomic agriculture; Froehlich, Klosterman

Animal and Range Sciences

H-037—Factors controlling the growth of turkey muscle cells in vitro; McFarland
S-043—Range and tame pasture production in western South Dakota; J.R. Johnson, Stymiest
H-044—Reproductive efficiency in commercial beef production; Pruitt
R-093—Beef cattle improvement through breeding; Marshall
H-153—Reproductive efficiency of sheep; Slyter
H-175—Corn-corn silage diets for feedlot cattle; Wagner
H-177—Management for integrated production of lean beef; Pritchard, Pruitt, Gee
H-185—Amino acid balance in swine diets, effects of pig growth, and nitrogen and mineral metabolism; Wahlstrom, Libal
H-195—Nutrient interrelationships affecting performance and body composition of swine; Libal, Wahlstrom
H-217—Effects of specific feed proteins on the amino acid nutrition of growing lambs; Pritchard
H-276—Shortening postpartum interval and increasing pregnancy rates in estrous synchronized beef cows; Miller
H-297—Optimizing grazing strategies on native and introduced rangelands; P. Johnson
R-307—Increasing prolificacy in sheep and its impact on nutritional needs; Slyter
H-314—Rangeland resource improvement; Gartner
H-357—Nutrient and management interrelationships affecting reproductive efficiency of swine; Libal, Wahlstrom
H-367—Effect of flaxseed in swine rations on omega-3 fatty acid development in body tissues; Romans

Biology

H-055—Tissue and cell culture techniques in breeding monocots; Chen, Boe, Wicks
H-095—Cytology of plant regeneration in tissue cultures of monocots; McMullen, Chen
H-296—Controlling early embryo mortalities; Granholm

Dairy Science

H-027—Properties and applications of ultrafiltered milk; Mistry
R-137—Metabolic relationships in nutrient supply for lactating cows; Schingoethe
R-147—Dairy herd management strategies for improved decision making and profitability; Sommerfeldt
H-157—Composition, quality, and consumer acceptance of milk and dairy products; Baer
H-206—Whey utilization by dairy cattle; Schingoethe
H-257—Analysis of dairy products; Parsons
H-317—Quality, microbiological safety, and profitability of dairy products; Torrey
R-382—Nutritional utilization of forages by dairy cattle; Sommerfeldt

Economics

H-075—Economic analysis of South Dakota farmer experience with reduced tillage systems; Taylor, Dobbs
H-076—Economics of farming systems alternatives in eastern South Dakota; Dobbs, Taylor
R-086—Determinants of farm size and structure in north-central areas of the U.S.; Janssen
H-087—Economic analysis of South Dakota rangeland values, lease and rental rates, and grazing fees; Beutler
H-096—Impact of the 1986 federal tax reform on South Dakota agriculture; Lundeen
H-106—Grain price and interest rate risk management for South Dakota producers and agribusinesses; Schmiesing
H-11— Economic analyses of farmland values, rental practices, and financing arrangements in South Dakota; Janssen
H-125—Effect of changes in transportation on performance of the U.S. agricultural transportation system; Lamberton
H-226—Financing agriculture in a changing environment: macro, market, policy, and management issues; Lamberton
H-266—Analysis of marketing strategies to reduce price risk for South Dakota livestock producers; Ellingson

Home Economics

H-205—Tissue levels of pesticides in South Dakota residents on normal and calorie-restricted diets; Crews, DeZeeuw
H-337—Pesticide residues in human milk samples from South Dakota residents; Bohannon, Crews, DeZeeuw
H-397—Textile properties influencing pesticide contamination by soil redeposition; Hallberg

Horticulture, Forestry, Landscape & Parks

MS-004—Genetic improvement of tall tree species for South Dakota; Schaefer
H-164—Superior native and introduced trees and shrubs for South Dakota; Evers
H-166—Micropropagation of herbaceous perennials: anemone pulsatilla, dictamnus albus, and salvia x superba; Spinksi
H-204—Breeding fruit cultivars and improving fruit cultural practices for South Dakota; Peterson, Gries
R-336—Strategies and procedures for advanced generation breeding of north-central forest species; Schaefer
MS-387—Factors in the success/failure of ponderosa pine regeneration in the Black Hills; Schaefer
H-474—Increasing vegetable yields in South Dakota; Prashar

Microbiology

H-126—Chemotaxonomic characterization of pesticide-degrading bacteria; Gauger
H-155—Mycorrhizae and associated nitrogen fixation; Todd
H-165—Fuel ethanol and feed byproduct production from alternative feedstocks; Westby
H-327—Biological nitrogen cycling in agricultural soils; Todd
H-374—Nitrogen fixation and guanine metabolism in soil bacteria; Westby

Plant Science

SD-2-2792—Development of tissue culture techniques in sunflower (Helianthus annus L.); Lay
R-005—Nutrient management in conservation tillage to improve productivity and environmental quality; White
H-016—Root growth and development of corn with respect to tillage system and landscape position; Schumacher
H-017—Faba beans as an alternate crop for South Dakota; Sorensen
H-024—Alternative farming systems; Smolik, Fixen, Hall
H-025—Effects of starter fertilization on corn under different cultural and environmental conditions; Fixen
MS-047—Understory herbage production: soil and forestry factors in the limestone uplands of the Black Hills; Lemme
CG-053—National Agricultural Pesticide Impact Association Program; Walgenbach
H-057—Soil survey information for agrotechnology transfer and soil productivity relationships in South Dakota; Malo
H-067—Residue management effects on nitrate and pesticide leaching and water quality; Kohl

H-077—Environmental and biological stress in wheat; Gellner
R-094—Bionomics, vector capabilities, and management strategies for face flies; Easton
H-097—Oats and rye adapted for South Dakota; Reeves
H-105—Suppression of stable fly population in beef cattle by sterile insects; Easton
H-107—Nutritive quality, growth, and production of forage crops; Kephart
H-117—Genetics of host-pathogen interactions of row crops in South Dakota; Carson
H-127—Phenotypic variation in tissue water transport during dehydration and rehydration of winter wheat; Kenefick
R-186—Introduction, maintenance, evaluation, and utilization of plant germplasm; Boe
H-193— Breeding and genetics of flax and sunflower; Lay, Grady, Ferguson
H-203—Corn breeding; Wicks, Carson
H-213—Spring wheat breeding and genetics; Cholick, Buchenau
R-234—Biological control of soil-borne plant pathogens in integrated crop management systems; Buchenau, Smolik, Rizvi
H-244—Freeze selection effects on membrane proteins and the cell cycle in winter cereals; Kenefick
H-245—Potato diseases in South Dakota; Gallenberg
H-253—Amelioration of claypan-range-soil properties to increase forage production; White
H-265—Germination and purity procedures for forage and revegetation species common to South Dakota; Gutormson
H-267—Water quality of soil water under intensively cultivated fields; Carlson
H-273—Entomorphage grylli, a pathogen of grasshoppers; McDaniel
H-277—Breeding evaluation of forage grasses in South Dakota; Boe
R-282—Reduction of corn losses caused by nematodes in the North-Central Region; Smolik
H-286—Ecology and control of western and northern corn rootworm in South Dakota; Walgenbach, Elliott, Hein
R-287—Seed production of breeding lines of insect-pollinated forage legumes; Boe
R-304—Arthropod management and economic losses from insects, mites, and ticks on livestock; Easton
H-306—Determination of water stress with isotopic ratios of carbon-12 and carbon-13; Beck
H-316—Cropping systems in western South Dakota; Stymiest, Rickerl, Jacobson, Johnson
R-333—Soil productivity and erosion; Schumacher, Lemme, Lindstrom
H-346—Economics and ecology of farm systems and conservation tillage; Rickerl, Weeldreyer, Stymiest, Sorensen, Smolik, Beck
H-356—Detection and control of soybean diseases in South Dakota; Ferguson
S-401—Foundation Seed Stock; Ingemansen
S-402—Seed certification; Pollman
S-403—Seed testing; Gutormson
S-404—Variety testing; Bonnemann
S-406—Survey entomologist; Walgenbach
S-482—Physiological regulation of individual components of seed yield; Dybing
R-504—Integrating crop culture, chemicals, and life cycles to control persistent weeds; Arnold

Rural Sociology

H-167—Census Data Center; Satterlee

Station Biochemistry

CG-046—Flow cytometic analysis of bull sperm fertility; Evenson, Ballachey
H-116—Extraction methods in trace organic analysis of agricultural samples; Matthees
H-145—Flow cytometry; Evenson
H-394—Mineral nutrition and metabolism in animals; Emerick
H-404—Biochemistry of selenium; Palmer
S-407—Analytical services, Thiex

Veterinary Science

CG-056—Modified live escherichia coli vaccine for colibacillosis of pigs; Francis
R-066—Bovine respiratory disease: risk factors, pathogens, diagnosis, and management; Vickers
AH-136—Epidemiology of rotavirus infection in swine; Janke, Benfield
AH-225—Monoclonal antibodies and enzyme-linked immunosorbant assay (elisa) to diagnose bovine viral diarrhea; Vickers
AH-227—Development of a diagnostic panel for the diagnosis of calf diarrhea; Benfield
H-237—Antibiotics, bacteria, and bacterial toxins and structure and function of porcine alveolar macrophages; Libal, Vickers, Zeman
AH-326—Effects of nutrition and management on susceptibility of calves to enteric diseases; Francis, Benfield, Libal, Owens, Sommerfeldt
R-347—Prevention and control of enteric diseases of swine; Francis, Benfield, Janke
H-366—Antibody protection of the conceptus from porcine parvovirus-contaminated semen; Kirkbride, Steen, Vickers
CG-544—Role of cellular receptors in the pathogenesis of porcine enteric viral infections; Benfield

Wildlife and Fisheries Sciences

H-026—Development of polyploid fishes for South Dakota waters; Scalet
H-036—Management strategies to enhance South Dakota pond fishery resources; Modde
MS-514—Relationships of forests and agriculture to turkey management in eastern South Dakota; Flake
H-534—Assessment of riparian habitat damage caused by aquatic furbearers; Jenkins
S-492—South Dakota Cooperative Fish and Wildlife Research Unit; Berry, Higgins

Articles, publications

Agricultural Engineering

Refereed articles:

Alcock, R. 1987. Battery powered skid-steer loader. Agricultural Engineer 42(1):4.

Christianson, L.L., R. Alcock, D.P. Froehlich, and K.J. Chicoine. 1987. United States Patent "Skid-Steer Vehicle." Patent Number: 4,705,449. Washington, DC.

Chu, S.T. 1987. Determination of green-ampt parameters using a sprinkler infiltrometer. Sprinkler Technology 44(2):55. Wy-Han Institute of Hydraulic and Electric Engineering, China (Translated by X.M. Chen).

DeBoer, D.W., A. Moshref-Javadi, and S.T. Chu. 1988. Application of the green-ampt infiltration equation to sprinkler irrigation management. ASAE Applied Agri Res 3(3):128.

Diesch, M.A., and D.P. Froehlich. 1988. Production and environmental simulations in livestock housing. Trans ASAE, Ms SE987.

Kohl, K.D., R.A. Kohl, and D.W. DeBoer. 1987. Measurement of low pressure sprinkler evaporation loss. Trans ASAE 30(4):1071.

Raap, D.L., and D.P. Froehlich. 1988. Zone and drip cooling comparisons for lactating swine. Trans ASAE, Ms SE1005.

Other reports:

Alcock, R., and D.P. Froehlich. 1987. Surface hardening of soil contact components. ASAE Paper NCR-87-203.

Beck, D.L., and D.P. Froehlich. 1987. All crop no till drill. ASAE Paper NCR-87-204.

Chu, S.T., C.A. Onstad, and W.J. Rawls. 1987. Evaluating soil crusting parameters with a rain simulator. ASAE Paper 87-2003.

_____, _____, and _____. 1987. Macropores in the soil infiltration process. ASAE Paper 87-2532.

DeBoer, D.W., D.L. Beck, and B.M. Ketelhut. 1987. Primary and secondary tillage for surface runoff control under sprinkler irrigation. ASAE Paper 87-2015.

Diesch, M.A., and D.P. Froehlich. 1987. Characteristics of nursery feed dispensers for swine. ASAE Paper NCR-87-504.

_____ and _____. 1987. Environmental simulation of animal growth in livestock structures. ASAE Paper 87-4514.

_____. 1987. Production and environmental simulations for livestock housing. MS thesis, SDSU.

Djakaria, R., J. Julson, S. Pohl, V.C. Kelley, and W. Gibbons. 1988. Engineering aspects of edible mushroom compost production, a case study. ASAE Paper 88-6081.

Finnern, S., D.L. Beck, C.G. Carlson, and D.W. DeBoer. 1987. Optimizing management techniques for a shallow tile drain irrigation system. Agronomy Abstracts:240.

Kohl, R.A., and D.W. DeBoer. 1987. Nozzle and flow geometry effects on droplet size distributions. ASAE Paper 87-2591.

Raap, D.L., and D.P. Froehlich. 1987. Soil/crop observations due to reduced tillage. ASAE Paper NCR-87-601.

_____. 1987. Zone and drip cooling comparison for lactating swine. MS thesis, SDSU.

Schulz, J., and D.P. Froehlich. 1987. Performance characteristics of a mist sprayer. ASAE Paper NCR-87-201.

Schumacher, J.A., D.P. Froehlich, and T.M. Klosterman. 1988. Granular applicator for in-ground placement of chemicals. ASAE Paper 88-1014.

Stange, K.W., and D.W. DeBoer. 1987. Distribution patterns for reduced pressure spinklers. ASAE Paper 87-2016.

Steele, D.D. 1987. Using drainmod to estimate hydraulic parameters in slowly permeable soils. MS thesis, SDSU.

Ullery, C.H., G. Kimball, A.R. Bender, and C.G. Carlson. 1987. Oakwood Lakes-Poinsett rural clean water program project: addressing agricultural nonpoint pollution of groundwater. ASAE Paper NCR-87-301.

_____. 1988. Addressing agricultural nonpoint source water pollution: the Oakwood Lakes-Poinsett rural clean water program project. North Central Region Eight State Groundwater Workshop Proceedings.

Van Zee, R.J., and D.W. DeBoer. 1987. Irrigation requirements and corn yields for east central South Dakota. ASAE Paper NCR-87-304.

Animal and Range Sciences

Refereed articles:

Dinkel, C.A. 1988. Interaction of cow size with growth potential of the service sire. Can J Anim Sci 68:129.

Gartner, F.R. 1988. Improvement practices that increase range efficiency. Pp 86-91 IN R.S. White and R.E. Short (eds), Proc Fort Keogh Res Symp, Sept 1987, Miles City, MT.

_____, F.D. Johnson, and P. Morgan. 1988. Cattle abortion from Ponderosa pine needles: ecological and range management considerations. Chapter 7 IN L.F. James, M.H. Ralphs, and D.B. Nielsen (eds), Ecology and economic impact of poisonous plants on livestock production. Westview Press, Boulder, CO.

Gordon, S.J., H.L. Miller, D.P. Evenson, and D.H. Gee. 1988. Comparison of anabolic implants on reproductive function, performance and carcass characteristics in weaned beef bulls. Can J Anim Sci 68:367.

Johnson, J.R. 1988. Assessment of extension technologies that succeed or fail: what can be done. Pp 115-119 IN R.S. White and R.E. Short (eds), Proc Fort Keogh Res Symp, Sept 1987, Miles City, MT.

Kashani, A.B., and C.W. Carlson. 1988. Use of sunflower seeds in grower diets for pullets and subsequent performance as affected by aureomycin and pelleting. Poul Sci 67:445.

Paterson, B.C., K.W. Jones, D.H. Gee, W.J. Costello, and J.R. Romans. 1988. Effects of carcass chilling temperature on loin steaks from bulls and steers. J Food Quality 11:43.

White, E.M., and F.R. Gartner. 1987. Salinity effects on blue grama (Bouteloua gracilis) growth in the greenhouse. Proc SD Acad Sci 66:76.

Other reports:

Borg, B.S., and C.R. Hamilton. 1988. Full fat soybeans for swine. SDCES Extension Extra 2004.

_____, _____, G.W. Libal, and R.C. Wahlstrom. 1987. Effect of energy concentration on the performance of growing-finishing pigs fed diets containing barley. J Anim Sci 65(Suppl 1):302.

_____, _____, _____, and _____. 1988. Effect of processing method and lysine and energy concentration on performance of pigs fed barley based diets. J Anim Sci 66(Suppl 1):129.

_____, _____, _____, and _____. 1987. Effects of lysine and energy concentration on the performance of growing and finishing pigs fed diets containing barley. SDAES SWINE 87-4:15.

_____, _____, _____, and _____. 1987. Efficacy of phytic acid as an indigestible marker for use in weanling pig digestibility studies. SDAES SWINE 87-5:19.

_____, G. W. Libal, and R.C. Wahlstrom. 1987. Effects of dietary protein level and fat supplementation on performance and serum parameters of young weaned pigs. SDAES SWINE 87-14:52.

Chen, C.M., K.W. Jones, P.S. DeZeeuw, and W.J. Costello. 1987. Effects of heating rate and endpoint temperature on the palatability and storage stability of precooked beef roasts. SDAES Beef Report CATTLE 87-17:65.

Easton, E.R., and G. Bennett. 1987. Efficacy of Terminator, Max-Con and Y-Tex experimental impregnated ear tag (NC.602TC) for the control of resistant populations of the horn fly in South Dakota during 1987. SDAES Beef Report CATTLE 87-13:48.

Fritz, T.M., and R.H. Pritchard. 1987. Evaluation of a semi-purified diet for suitability in nitrogen metabolism studies. J Anim Sci 65(Suppl 1):478.

Gartner, F.R. 1988. South Dakota research: past and present. 11th Annual Rancher's Forum, Feb 18, Faith, SD.

Hamilton, C.R., B.S. Borg, G.W. Libal, and R.C. Wahlstrom. 1987. Effects of feeding barley in ground, dry-rolled or pelleted form on the performance of growing-finishing pigs. SDAES SWINE 87-2:7.

_____, _____, _____, and _____. 1987. Effect of lysine and energy concentration on performance of pigs fed barley-based diets from 56 lb to market weight. SDAES SWINE 87-3:11.

_____, _____, _____, and _____. 1987. Effects of adding growth promoting levels of virginiamycin or bacitracin methylene disalicylate (BMD) on the performance of pigs fed corn or barley-based diets from 66 lb to market weight. SDAES SWINE 87-6:22.

_____, G.W. Libal, and R.C. Wahlstrom. 1987. Utilizing 1987 SDSU nutrient recommendations for swine. SDAES SWINE 87-1:1.

_____ and D.M. Marshall. 1988. Use or misuse of crossbreeding programs can affect profitability for swine producers. SDCES Extension Extra 2003.

Hoppe, M.K., C.R. Hamilton, B.S. Borg, G.W. Libal, and R.C. Wahlstrom. 1988. Effect of grain source and antibacterial agents (virginiamycin or bacitracin methylene disalicylate) on grower-finisher pigs. J Anim Sci 66(Suppl 1):128.

_____, G.W. Libal, and R.C. Wahlstrom. 1987. Effect of water flow rate from nipple drinkers on sow performance during lactation. SDAES SWINE 87-11:43.

_____, _____, and _____. 1987. Effect of water flow rate from nipple drinkers on weaned pig performance. SDAES SWINE 87-12:46.

_____, _____, and _____. 1987. Effect of diet composition on postweaning nutrient absorption, incidence of diarrhea and bacterial and viral proliferation. SDAES SWINE 87-13:49.

Johnson, J.R. 1987. Optimum utilization of a grazing forage base. Proc Range Beef Cow Symp X:152, Dec 8-10, Cheyenne, WY.

_____ and M.K. Bentler (eds). 1988. Proc Northern Plains Grass Seed Symposium, January 7-8, Pierre.

Johnson, P.C., and C.L. Johnson. 1988. Determining biomass and utilization in grasses using height-to-weight and volume-to-weight relationships. Proc Soc Range Mgmt Abstr 171.

Johnson, R.C. 1988. Algin/calcium gels in solid-muscle structured beef steaks. PhD thesis, SDSU.

_____, C.M. Chen, T.S. Muller, W.J. Costello, J.R. Romans, and K.W. Jones. 1987. Characterization of the muscles within the beef forequarter. SDAES Beef Report CATTLE 87-16:59.

_____, T.S. Muller, C.M. Chen, W.J. Costello, and J.R. Romans. 1987. Factors affecting ham star fat. J Anim Sci 65(Suppl 1):280.

Krcil, L.C., and A.F. Schlundt. 1988. Steer performance in three simple grazing schemes for prairie pothole range. Proc Soc Range Mgmt Abstr 407.

Kruse, J.L., and R.C. Johnson. 1988. Improving performance of in-home consumer panels. J Anim Sci 66(Suppl 1):93.

Libal, G.W., M.K. Hoppe, D.A. Jensen, B.S. Borg, and R.C. Wahlstrom. 1987. Effect of banminth-mecadox and protein level from weanling to 75 lb on protein deposition and performance of pigs. SDAES SWINE 87-7:27.

_____, _____, and R.C. Wahlstrom. 1987. Effect of vegetable fat and artificial flavor additions to sow diets during late gestation and lactation. SDAES SWINE 87-8:34.

_____, _____, and _____. 1987. Effect of dietary fat additions to lactation diets on sow and pig performance. SDAES SWINE 87-9:37.

_____ and R.C. Wahlstrom. 1987. Effect of chickpeas as the sole source of energy and protein for sow in late gestation and lactation. SDAES SWINE 87-10:40.

Mader, T.L., and J.J. Wagner. 1987. Limit-fed high energy diets for growing steers. J Anim Sci 65(Suppl 1):473.

Marshall, D.M. 1987. Interpreting experimental results. SDAES Beef Report CATTLE 87-1:1.

_____ and C.A. Dinkel. 1987. Evaluation of varying levels of Hereford, Simmental, and Angus breeding for calf production through weaning. SDAES Beef Report CATTLE 878-15:55.

_____ and _____. 1988. Characterization of breed types for calf production through weaning. J Anim Sci 66(Suppl 1):106.

Momont, P.A. 1987. Effects of body condition on reproductive performance of range beef cows. MS thesis, SDSU.

_____ and R.J. Pruitt. 1988. Relationships between body condition scores and live animal measurements in beef cows. J Anim Sci 66(Suppl 1):112.

_____, _____, and R.H. Pritchard. 1987. Serum d-B-hydroxybutyrate and urea nitrogen as indicators of beef cow nutritional status. J Anim Sci 65(Suppl 1):494.

Muller, T.S., R.C. Johnson, W.J. Costello, and J.R. Romans. 1988. Effect of accelerated processing on beef forequarter muscle tenderness. J Anim Sci 66(Suppl 1):96.

Naasz, C.D. 1987. Effects of bull exposure on postpartum interval and reproductive performance in beef cows. MS thesis, SDSU.

_____, H.L. Miller, and R.H. Haigh. 1987. Effects of bull exposure on postpartum interval and reproductive performance in beef cows. SDAES Beef Report CATTLE 87-14:52.

_____ and _____. 1987. Effect of bull exposure on postpartum interval and reproductive performance of beef cows. J Anim Sci 65(Suppl 1):426.

NRC-42 Committee on Swine Nutrition. 1988. Effects of dietary protein on performance and carcass traits of barrows and gilts. J Anim Sci 66(Suppl 1):143.

Pritchard, R.H. 1987. Feeding high grain diets to steer calves with different feedlot arrival weights. SDAES Beef Report CATTLE 87-11:41.

_____, J.K. Swann, and M.A. Robbins. 1987. Three-year summary of preconditioning effects on pre- and postshipment performance of feeder calves. SDAES Beef Report CATTLE 87-10:37.

Pruitt, R.J., and R.H. Haigh. 1987. SDSU purebred beef herds. SDAES Beef Report CATTLE 87-2:2.

_____ and P.A. Momont. 1987. Body condition and reproductive performance of beef cows. Proc Range Beef Cow Symp X:211.

_____ and _____. 1987. Effects of body condition on reproductive performance of range beef cows. SDAES Beef Report CATTLE 87-9:29.

Schlundt, A.F. 1988. Cottonwood Range and Livestock Research Station: A valuable range management reference area for the Northern Great Plains. Proc Soc Range Mgmt Abstr 302.

Sip, M.L., and R.H. Pritchard. 1988. Optimal levels of crude protein and monensin in high-concentrate limit-fed diets. J Anim Sci 66(Suppl 1):156.

_____, _____, and M.L. Robbins. 1987. Optimum levels of dietary crude protein and monensin for steer calves on limit-fed, high concentrate diets. SDAES Beef Report CATTLE 87-6:16.

Twidwell, E.K., J.R. Johnson, and C. Stymiest. 1988. How to establish forage grasses. SDCES EC759.

Wagner, J.J. 1987. Alternate feeding of corn and corn silage diets to feedlot cattle. SDAES Beef Report CATTLE 87-7:20.

_____. 1987. Effect of restricting feed intake during the finishing phase on feedlot performance and dietary energy utilization. SDAES Beef Report CATTLE 87-8:23.

_____. 1987. Rumen injectable probiotic and probiotic feed additive for newly arrived feedlot cattle. SDAES Beef Report CATTLE 87-12:45.

_____ and T.L. Mader. 1987. Limit-fed, high energy diets for growing cattle. SDAES Beef Report CATTLE 87-4:7.

_____ and _____. 1987. Urea, corn gluten meal, or soybean meal as supplemental crude protein sources for feedlot steers limit-fed high energy growing diets. SDAES Beef Report CATTLE 87-5:11.

Wahlstrom, R.C., B.S. Borg, and G.W. Libal. 1987. Amino acid balance in pig starter diets. SDAES SWINE 87-15:55.

_____, _____, and _____. 1987. Effects of fat, copper and B-vitamin supplementation on performance of growing-finishing swine. SDAES SWINE 87-16:58.

Whittington, D.L. 1987. Comparison of Ralgro, Compudose and Synovex S implants on the growth performance of yearling steers grazing native forage. J Anim Sci 65(Suppl 1):333.

Wolf, A.M. 1987. Effect of photoperiod and melatonin on reproductive performance of anestrous ewes. MS thesis, SDSU.

Biology

Refereed articles:

Chen, C.H. 1988. Present status of forage grass tissue culture research in South Dakota. Sci Agri (Taiwan) (in press).

_____, W.A. Sargent, A.A. Boe, and Z.W. Wicks II. 1988. Plant regeneration in inflorescence cultures of intermediate wheatgrass (Agropyron intermedium (Host) Beauv.) Proc SD Acad Sci (in press).

Granholm, N.H., G.A. Dickens, and M.A. Schoessler. 1988. Reproductive efficiency in aging lethal yellow female mice (Ay/a; C57BL/6J) following reciprocal matings and ovary grafts. Proc SD Acad Sci 67:ABS (in press).

_____, K.E. Kappenman, A.J. Opbroek, and P.L. Munns. 1988. Multiple tyrosinases and dopa oxidase activities in hairbulb melanocytes of mutant (Ay, c2J) mice. ABS I-5. Pan American Pigment Cell Biology Meeting, June 24-26, U Minnesota, Minneapolis.

Hugghins, E.J., H.H. Casper, and C.D. Ward. 1988. Tissue fluoroacetate residues in prairie dogs dosed with low-level monofluoroacetate. J Assoc Official Anal Chem 71(3):579.

Japs, R.A., K.E. Kappenman, and N.H. Granholm. 1988. Development of hairbulb pigment cell melanosomes in compound agouti and albino locus mouse mutants (C57BL/6J). ABS I-6. Pan American Pigment Cell Biology Meeting, June 24-26, U Minnesota, Minneapolis.

Opbroek, A.J., P.L. Munns, K.E. Kappenman, and N.H. Granholm. 1988. Multiple molecular forms of tyrosinase and protein components in hairbulb preparations of mutant mice (C57BL/6J-Ay, a, and c2J). Proc SD Acad Sci ABS (in press).

Schoessler, M.A., and N.H. Granholm. 1988. Hypothalamus- pituitary function in aging obese lethal yellow mice. (Ay/a; C57BL/6J). Proc SD Acad Sci ABS (in press).

Yao, K.S., C.H. Chen, and C.R. McMullen. 1987. Organogenesis in inflorescence cultures of Indiangrass (Sorghastrum nutans (L.) Nash). Proc SD Acad Sci 66:85.

_____, _____, and _____. 1988. Behavior of pollen grains in cultured anthers of big bluestem (Andropogon gerardii Vitman). Proc SD Acad Sci (in press).

Other reports:

Chen, C.H., and A.A. Boe. 1988. Big bluestem (Andropogon gerardii Vitman), little bluestem (Schizachyrium scoparium (Michx.) Nash) and Indiangrass (Sorghastrum nutans (L.) Nash.). Pp 444-457 IN Y.S.P. Bajaj (ed), Biotech in Agri Forest vol 6 Crop II. Springer-Verlag, New York.

Whalen, R.H., and A.L. Kahler. 1988. Chromosome location of peroxidase-1. Maize Genet Coop NewsLetter 62:34.

Gerdes, J.T. 1988. Inheritance of nine enzyme loci in sunflower (Helianthus annuus L.) and estimation of outcrossing rates in Helianthus germplasm pool II. MS thesis, SDSU.

Dairy Science

Refereed articles:

Casper, D.P., and D.J. Schingoethe. 1988. Protected methionine supplementation to a barley based diet for cows during early lactation. J Dairy Sci 71:164.

_____, _____, R.P. Middaugh, and R.J. Baer. 1988. Lactational responses of dairy cows to diets containing regular and high oleic acid sunflower seeds. J Dairy Sci 71:1267.

Hadsell, D.L., and J.L. Sommerfeldt. 1988. Chickpeas as a protein and energy supplement for high producing dairy cows. J Dairy Sci 71:762.

Illg, D.J., J.L. Sommerfeldt, and A.A. Boe. 1987. Chickpeas as a substitute for corn and soybean meal in growing heifer diets. J Dairy Sci 70:2181.

Schingoethe, D.J., D.P. Casper, C. Yang, D.J. Illg, J.L. Sommerfeldt, and C.R. Mueller. 1988. Lactational response to soybean meal, heated soybean meal, and extruded blend of soybeans and soybean meal. J Dairy Sci 71:173.

Sommerfeldt, J.L., and K.A. Lyon. 1988. Ration digestibilities and ruminal characteristics in steers fed chickpeas. J Dairy Sci 71:843.

Whalen, C.A., T.M. Gilmore, K.R. Spurgeon, and J.G. Parsons. 1988. Yogurt manufactured from whey caseinate blends and hydrolyzed lactose. J Dairy Sci 71:299.

Other reports:

Baer, R.J., K.M. Tieszen, D.J. Schingoethe, and D.P. Casper. 1988. Composition and flavor of milk produced by cows injected with recombinant bovine somatotropin. J Dairy Sci 71(Suppl 1):115 (abstr).

_____. 1988. Production of dairy products higher in unsaturated fatty acids. SD Nutrition Council Newsletter 4(2):4.

Casper, D.P., D.J. Schingoethe, and W.A. Eisenbeisz. 1987. Lactational responses of early lactation dairy cows fed diets varying in ruminal degradability of carbohydrate and crude protein. Proc, Conf on Rumen Function 19:10 (abstr).

_____, _____, and _____. 1988. Lactational response to diets which vary in ruminal degradability of carbohydrates and amount of fat. J Dairy Sci 71(Suppl 1):177 (abstr).

_____. 1988. Storage losses of large round bales. SDSU Dairymen's Conf, DSU 88-2.

Eisenbeisz, W.A., D.P. Casper, D.J. Schingoethe, and F.C. Ludens. 1988. Lactational evaluation of recombinant bovine somatotropin with corn and barley diets: response to diets. J Dairy Sci 71(Suppl 1):122 (abstr).

_____, _____, _____, _____, and R.D. Shaver. 1988. Lactational evaluation of recombinant bovine somatotropin with corn and barley diets: response to somatotropin. J Dairy Sci 71(Suppl 1):123 (abstr).

Hadsell, D.L. 1987. Chickpeas as a protein and energy supplement for high producing dairy cows. MS thesis, SDSU.

Middaugh, R.P. 1988. Characteristics of milk and butter from cows fed sunflower seeds. MS thesis, SDSU.

Mistry, V.V. 1987. New starter medium for cheese from ultrafiltered milk. 7th ann mtg, North Central Cheese Industries Assoc, Sept 9-10, St. Paul, MN.

_____. 1987. Restoration of quality and yield of cheese from high somatic cell milks. Cheese Biotechnology and International Food Development Symposium, Oct 19-20, Ithaca, NY.

_____. 1988. Review of UF/RO membrane technology. SDSU Henkel Corp Sanitation Technology Seminar in the Dairy Industry, May 15- 17, Brookings.

_____. 1988. New applications of ultrafiltration for cheesemaking. 31st ann conf, Canadian Institute of Food Sci and Technology, May 29-June 1, Winnipeg, Canada.

_____. 1988. Heat inactivation of alkaline phosphatase in ultrafiltered milk. J Dairy Sci 71(Suppl 1):73 (abstr).

Parsons, J.G. 1988. Detection of antibiotic residues in milk. SDSU Dairymen's Conf, DSU 88-7.

_____. 1987. Educating dairy industry leaders of tomorrow. 29th ann mtg, Dairy Div, National Assoc of State Dept of Ag, July 20- 23, Rapid City.

Schingoethe, D.J. 1987. Whey products in feeds for swine. Pp 106-110 IN Trends in whey utilization. Bull No 212 of International Dairy Federation, Brussels, Belgium.

_____. 1988. Feeding supplemental fat to dairy cows. SDSU Dairymen's Conf, DSU 88-1.

_____. 1988. Feed additives for the dairy herd. SDSU Dairymen's Conf, DSU 88-6.

_____. 1988. Nutrient needs of ruminants versus monogastric species. Pp 448-455 IN D.C. Church, (ed), Ruminant animal. Prentice Hall, Englewood Cliffs, NJ.

_____, F.M. Byers, and G.T. Schelling. 1988. Nutrient needs during critical periods of the life cycle. Pp 421-447 IN D.C. Church (ed), Ruminant animal. Prentice Hall. Englewood Cliffs, NJ.

Torrey, G.S., R. Reddy, M.J. McKenzie, and P.F. Roessler. 1988. Suppression of growth of psychrotrophic bacteria resulting from carbon dioxide added to ultrafiltered whole milk retentate. J Dairy Sci 71(Suppl 1):118 (abstr).

Voelker, H.H., S.S. Ray, Q. Mazumder, and F.C. Ludens. 1988. Selection of Holstein sires for high predicted difference milk or type. J Dairy Sci 71(Suppl 1):269.

_____. 1988. Get an early start with dairy cattle judging. Hoard's Dairyman 133(10):515.

_____. 1987. Culling cows. SD Holstein News 56(3):12.

_____. 1987. Dairy cow health costs. SD Holstein News 56(3):14.

_____. 1988. Dairy cattle breeding takes time. SD Holstein News 57(1):8.

Economics

Refereed articles:

Dobbs, T.L., M.G. Leddy, and J.D. Smolik. 1988. Factors influencing the economic potential for alternative farming systems: case analyses in South Dakota. Amer J of Alternative Agric 3(1) (in press).

Janssen, L.L. 1988. Book review: Private interest, public policy, and American agriculture. Amer J of Agric Econ 70(4) (in press).

Lundeen, M., L.L. Janssen, and B. Johnson. 1988. Characteristics of and participants in farmland rental markets. J of Fm Mgr and Rur Appraisal 52(2) (in press).

Schmiesing, B.H., L.L. Janssen, and B.W. Pflueger. 1988. Agricultural bankers' reactions to Chapter 12 bankruptcy. J of Fm Mgr and Rur Appraisal 52(1):43.

Taylor, D.C. 1988. Third world ag development effects of U.S. ag exports: it depends. Choices 3(3):28.

_____. 1988. Economic impacts of irrigation load management controls. Energy Systems and Policy 12(1) (in press).

Other reports:

Beutler, M.K. 1987. Rangeland resources in South Dakota. Chpt 14 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1987. Economic consideration of producing high quality forage. IN Proc, South Dakota forage and grassland council first annual winter meeting, Dec 15, Watertown.

_____. 1988. Estimating returns to grass seed production. IN Proc, Northern Plains grass seed symposium, Jn 7-8, Pierre.

_____. 1988. Economic considerations in producing and feeding quality alfalfa hay. Econ N/L 259.

Chan, Lai Kheng. 1988. Hedging prime interest rate and Bank for Cooperatives rates by using financial futures for South Dakota agricultural cooperatives. MS thesis, SDSU.

Dobbs, T.L. 1987. Feasibility analysis: an essential tool in agricultural and rural revitalization efforts. Chpt 21 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____ and D.C. Taylor. 1987. Reduced tillage and alternative farming systems: potential for increasing agricultural profitability. Chpt 15 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1988. Economic feasibility methods: new agricultural and rural enterprises. SDAES B 703.

_____ and M.G. Leddy. 1988. Economics of alternative farming systems. IN 1987 annual progress report: northeast research station, Plant Science Dept.

Janssen, L.L. 1987. Structural changes in South Dakota agriculture: implications for our citizens. Chpt 1 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1987. South Dakota agricultural land market trends. Chpt 13 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1987. South Dakota farmland price trends and outlook. Econ N/L 256.

_____. 1988. South Dakota farmland values and sale values—long-term and recent trends—statewide, regional, and selected counties. Econ Dept Res Rep 88-1.

_____. 1988. South Dakota cropland and rangeland sales: statewide and regional, 1971-1987. Econ Dept Res Rep 88-2.

_____. 1988. Long-term and recent trends in South Dakota farmland markets. Econ N/L 261.

_____. 1988. Farmland leasing in South Dakota. SDAES B 704.

_____ and B.H. Schmiesing. 1987. Characteristics of farm reorganization bankruptcy filings. West J of Agric Econ 12(2):234 (abstr).

Johnson, J.R., and M.K. Beutler (ed). 1988. Proceedings of the northern plains grass seed symposium, Jan 7-8, Pierre.

Lamberton, C.E. 1987. South Dakota's grain transportation system. Chpt 8 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

Leddy, M.G. 1987. An economic analysis of alternative farming systems in northeastern South Dakota. MS thesis, SDSU.

_____. 1988. International lending to the third world. Econ Dept Staff Rep 88-1.

Lundeen, A.A., and C.H. Rasmussen. 1987. Taxation policies: implications for South Dakota agriculture. Chpt 6 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

Lundeen, M., L.L. Janssen, B. Johnson, and S. Peterson. 1987. Some issues of security and stability associated with farmland leasing. West J of Agric Econ 12(2):235 (abstr).

Madden, P., and T.L. Dobbs. 1988. Role of economics in achieving low-input sustainable farming systems. IN Proc, international conference on sustainable agricultural systems, Columbus, Ohio, Sept 19-23 (in press).

Meyer, N., T.L. Dobbs, and C. Ward. 1987. Extension delivery under budget stress. West J of Agric Econ 12(2):233 (abstr).

Ober, B.M. 1988. South Dakota elevators' winter wheat marketing practices and seasonality of cash wheat prices. MS thesis, SDSU.

Pflueger, B.W., and B.H. Schmiesing. 1987. Lenders' perceptions of borrower participation in crop insurance programs. Econ Dept Staff Paper 87-7.

Reis, P. 1987. Asset-liability management/interest rate risk of banks in South Dakota. MS thesis, SDSU.

Schmiesing, B.H. 1987. Changing employment structure of South Dakota agribusiness. Chpt 2 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1987. South Dakota grain production trends. Chpt 7 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1988. Economic theory and its application to supply cooperatives. Chpt 9 IN Cooperatives in agriculture. Prentice Hall, Englewood Cliffs, NJ (in press).

_____. 1988. Theory of marketing cooperatives and decision making. Chpt 10 IN Cooperatives in agriculture. Prentice Hall, Englewood Cliffs, NJ (in press).

_____ and B.M. Ober. 1988. Pricing of South Dakota hard red winter wheat. Econ N/L 262.

Shane, R.C., and W. Ellingson. 1987. Profitability of feeding cull cows. IN Proc, 10th range beef cow symposium, Dec 8-10, Cheyenne, WY.

Taylor, D.C. 1987. Load management controls: economic friend or foe of the irrigator? West J of Agric Econ 12(2):235 (abstr).

_____. 1987. Irrigation water and energy use: investment, operation, and pricing policies. Chpt 16 IN South Dakota's agricultural economy in perspective. Econ Dept ES 501.

_____. 1988. Crop yield losses under irrigation load management control. Econ N/L 258.

_____ and T.L. Dobbs. 1988. Reduced tillage economics research. Econ N/L 263.

_____, _____, and J.H. Shriver. 1988. South Dakota farmer-based reduced tillage crop budgets. Econ Dept Res Rep 88-3.

Woods, W.F., M. Baker, N.P. Bonnell, T.L. Dobbs, and J.J. Jacobs. 1987. Executive summary: symposium on the rural Great Plains of the future, Nov 3-5, Denver, CO (in press).

Horticulture, Forestry, Landscape & Parks

Refereed articles:

Peterson, R.M., and J.R. Waples. 1988. 'Gourmet' pear. HortSci 23(3):633.

_____, _____, and N.P. Evers. 1988. 'Valiant' grape. HortSci 23(2):417.

Schaefer, P.R., S. Dronen, and D. Erickson. 1987. Windbreaks: a plains legacy in decline. J Soil & Water Cons 42(4)237.

_____ and N.W. Baer. 1988. Eastern redcedar and Rocky Mountain juniper provenance test for windbreak suitability in eastern South Dakota. NJAF 5(2):129.

Other reports:

Maris, P., G. Lemme, P. Schaefer, and N. Baer. 1988. Windbreak renovation: crown density response to weed control and soils. IN Proc Soc of American Foresters national convention, Minneapolis, MN.

Schaefer, P.R., and N.W. Baer. 1988. Windbreak row spacing: tree height and windbreak condition. IN Proc Soc of American Foresters national convention, Minneapolis, MN.

Microbiology

Refereed articles:

Gibbons, W.R., and C.A. Westby. 1987. Effect of fodder beet cube size on ethanol production via diffusion fermentation. Biotech Lett 9:135.

_____ and _____. 1987. Effects of sodium meta bisulfite on diffusion fermentation of fodder beets for fuel ethanol production. Biotechnol Bioeng 30:909.

_____ and _____. 1988. Processing cereal grains, thin stillage, and cheese whey to fuel ethanol in a farm-scale plant. Biomass 15:25.

_____, _____, and E. Arnold. 1988. Semi-continuous diffusion fermentation of fodder beets for fuel ethanol and cubed protein feed production. Biotechnol Bioeng 31:696.

Todd, R.L. et al. 1987. Changes in soil nitrogen pools and transformations following forest clearcutting. IN W.T. Swank and D.A. Crossley, Jr. (eds), Forest hydrology and ecology at Coweeta. Springer-Verlag, New York.

_____ et al. 1987. Riparian forest communities and their role in nutrient conservation in an agricultural watershed. Amer J Alter Agric 2:114.

_____ et al. 1988. Competitiveness of selected Bradyrhizobium japonicum strains in midwestern USA soils. Soil Sci Soc Amer J 52:662.

Other reports:

Choi, K.Y. 1988. Assimilatory nitrate reduction in Azospirillum brasilense; mutants and expression of the genes in Escherichia coli recombinant strains. MS thesis, SDSU.

Djakaria, R., J. Julson, S. Pohl, V. Kelly, and W. Gibbons. 1988. Engineering aspects of edible mushroom compost production, a case study. ASAE Paper 88-6081.

McAloon, R.R. 1988. Growth of Campylobacter jejuni in autoclaved and irradiated media. MS thesis, SDSU.

McHenry, T., and R.L. Todd. 1988. Production of oyster mushrooms (Pleurotus ostreatus) as effected by substrate volume and quality. Ann Meet, Amer Soc Microbiol, Miami, FL.

Mogard, J.W. 1988. Expression of Leptospira biflexa serovar patoc antigens in Escherichia coli JA 221. MS thesis, SDSU.

_____ and H.N. Westfall. 1987. Expression of Leptospira antigens in Escherichia coli JA 221 and their use in serologic diagnosis of leptospirosis. Abst Ann Meet Am Leptospirosis Res Conf, Chicago, IL.

Oien, N.L., and R.P. Hillam. 1988. Alternations in DTH and lymphocyte reactivity in mice. Abst Ann Meet Amer Soc Microbiol, Miami Beach, FL.

Pengra, R.M., and J.K. Fuller. 1988. Laboratory manual for general microbiology. Bellwether Press, Minneapolis.

Todd, R.L. 1987. Raising oyster mushrooms. Proceedings, Adapt 2 Conference, Successful Farming, Kansas City, MO.

Plant Science

Refereed articles:

Boe, A., B. McDaniel, and K. Robbins. 1988. Patterns of American licorice seed predation by Acanthoscelides aureolus (Horn)(Coleoptera: Bruchidae) in South Dakota. J Range Mgmt 41(4)342.

Cholick, F.A., J.H. Hatchett, D.K. Steiger, G.W. Buchenau, and K.M. Sellers. 1988. Registration of 'Shield' wheat. Crop Sci 28:720.

Dybing, C.D., P.D. Evenson, and C. Lay. 1988. Relationships among daily flower production, length of the flowering period, and seed yield of flax. Crop Sci 28:287.

Gelderman, R.H. et al. 1988. Correlation of several soil N indices for wheat. Comm Soil Sci Pl Anal 19(6):755.

_____ and P.E. Fixen. 1988. Recommended nitrate-N tests. IN W.C. Dahnke (ed.), Recommended chemical soil test procedures for the North Central Region (in press).

Gellner, J.L. 1987. Number of loci controlling vernalization in several winter wheat cultivars differing in level of winterhardiness. SD Acad Sci 66:48.

_____. 1988. Prediction of superior yielding spring wheat and oat cultivars using past yield data. Agron J (in press).

Ghiasi, H., C. Paech, and C.D. Dybing. 1987. Free amino acid content and metabolic activities of setting and aborting soybean ovaries. Plt Physiol 85:91.

_____, _____, and _____. 1987. Changes in contents of chlorophyll, proteins and saccharides in leaves during plant development of determinate, semi-determinate, and indeterminate lines of soybean. Biol Plt 29:283.

Grady, K.A., C.L. Lay, and M.W. Ferguson. 1987. Registration of 'Rahab' flax. Crop Sci 27:362.

Hubbard, D.E., J.B. Millar, D.D. Malo, and K.F. Higgins. 1988. Soil-vegetation correlations in prairie potholes of Beadle and Deuel counties, South Dakota. USFWS Biol Rept 88(22).

_____, J.L. Richardson, and D.D. Malo. 1988. Glaciated prairie wetlands: soils, hydrology and land-use implications. IN G. Brooks (ed), Proc, National Symposium on Wetland Hydrology, Sept 16-18, Chicago, Ill. Assoc State Wetland Manag, Berne, NY.

Kangatharalingarm, N., and M.L. Carson. 1988. Technique to induce sporulation in Thanatephorus cucumeris. Plant Disease 72:146.

Kephart, K.D., R.H. Delaney, and R.H. Abernethy. 1988. Glyphosate uptake by sod-seeded alfalfa (Medicago sativa) and creeping foxtail (Alopercurus arundinaceus) seedlings. SD Acad Sci (in press).

Kieckhefer, R.W., and J.L. Gellner. 1988. Influence of plant growth stages on cereal aphid reproduction. Crop Sci 28(4):688.

Kohl, K.D., R.A. Kohl, and D.W. DeBoer. 1987. Measurement of low pressure sprinkler evaporation loss. Trans ASAE 30(4):1071.

Lay, C.L., K.A. Grady, and M.W. Ferguson. 1987. Registration of 'Clark' flax. Crop Sci 27:362.

Malo, D.D. 1988. Holocene sedimentation environment in a seasonal wetland in eastern North Dakota. Soil Survey Horizons (in press).

Reeves, D.W., J.T. Touchton, and D.H. Rickerl. 1988. Effect of nitrogen source and dicyandiamide on growth and water relations of cotton. Soil Sci Soc Am J (52):281.

Rickerl, D.H., W.B. Gordon, J.T. Touchton, and E.A. Curl. 1987. Effect of starter fertilizers on cotton production in legume residues. Soil Sci Plant Anal 18(11)1281.

_____, _____, E.A. Curl, and J.T. Touchton. 1988. Winter legume and tillage effects on cotton growth and soil ecology. Soil Tillage Res (11)63.

Schumacher, T.E., and A.J.M. Smucker. 1987. Ion uptake and respiration of dry bean roots subjected to localized anoxia. Plant and Soil 99:411.
Smolik, J.D. 1987. Effect of Paratylenchus projectus on growth of sunflower. Plant Disease 71:975.
_____ and P.D. Evenson. 1987. Relationship of yields and Pratylenchus spp population densities in dryland and irrigated corn. Ann Appl Nematology 1:71.
_____ and Z.W. Wicks, III. 1987. Reproduction of Pratylenchus hexincisus and P. scribneri in corn inbreds. Ann Appl Nematology 1:29.
Tuwafe, S., A.L. Kahler, A. Boe, and M. Ferguson. 1988. Inheritance and geographical distribution of allozyme polymorphisms in chickpea (Cicer arietinum L.). J Heredity 79:170.
Weaver, T., and J. Smolik. 1987. Soil nematodes of northern Rocky Mountain ecosystems: genera and biomasses. Great Basin Nat 47:473.
White, E.M., and F.R. Gartner. 1987. Salinity effects on blue grama (Bouteloua gracilis) growth in the greenhouse. SD Acad Sci Proc 66:76.
_____ and J.N. Dornbush. 1988. Soil changes caused by municipal wastewater applications in eastern South Dakota. Water Resources Bul 24:269.

Other reports:

Bonnemann, J.J. 1987. 1987 South Dakota corn performance trials. Plant Sci Pamph 3.
_____. 1987. 1987 South Dakota grain sorghum performance trials. Plant Sci Pamph 4.
Bopray, J.J. 1987. Impact of ponderosa pine thinning and slash management on the herbage production of selected soils in Custer State Park. MS thesis, SDSU.
Bortnem, R., and A. Boe. 1987. Forage yield responses of alfalfa cultivars across diverse South Dakota environments. Proc SD Acad Sci 66:102.
Buchenau, G.W., and J.D. Smolik. 1988. Soil microorganisms and fungistasis. IN Farming systems studies, 1987. Ann Prog Rept NE Farm. Plant Sci Pamph 5:39.
_____ and S.A. Rizvi. 1988. Control of foliage diseases on spring wheat using fungicides in 1987. Plant Sci Pamph 5:12.
_____ and _____. 1988. South Dakota wheat diseases. Ann Wheat Newsletter 34:159.
Buxton, D.R., and K.D. Kephart. 1988. Here's how to get the most from alfalfa. Hoard's Dairyman (in press).
Carson, M.L., and Z.W. Wicks, III. 1987. Response of A632 type maize inbred lines in hybrid combination to leaf freckles and wilt caused by Clavibacter michiganese susp nebraskense. Phytopath 77:1772 (abstr).
Cooley, K.E., D.D. Malo, P.E. Fixen, and P.D. Evenson. 1987. Subsoil nutrient levels, soil genesis, and soil classification in selected northeastern (MLRA 102A) South Dakota soils. Agron Abstr 79:200.
_____, _____, _____, _____, and W.K. Schumacher. 1987. Subsoil nutrient levels in selected northeastern South Dakota (MLRA 102A) soils. Plant Sci, Soil Fertility PR 86-12.
_____, _____, _____, _____, and _____. 1988. Subsoil nutrient levels in selected northeastern (MLRA 102A) South Dakota: Part 2. Plant Sci, Soil Fertility PR 87-22.
Dybing, C.D. 1988. Significance of relative flowering rate for flax physiology and modeling. Flax Inst US, Proc 52:1.
Espinasse-Gellner, A., and C. Lay. 1988. Development of tissue culture techniques in sunflower (Helianthus annuus L.). Report of results, USDA grant 86-CRSR-2-2792.
_____ and C. Lay. 1988. In vitro regeneration of sunflower plants, Helianthus annuus L., from globular- to torpedo-shaped embryos. Proc, Sunflower Research Workshop, Aberdeen.
Farber, B.G., and P.E. Fixen. 1987. Farming system effects on soil nutrient status. Plant Sci, Soil Fert PR87-12.
_____, _____, R. Gelderman, and J. Gerwing. 1987. Chloride management in a small grain rotation. Plant Sci, Soil Fert PR87-16.
_____, _____, J.R. Gerwing, G.W. Buchenau, and G.L. Erickson. 1987. Placement of N, P, K, and Cl fertilizer for wheat production in the Northern Great Plains. Plant Sci, Soil Fert PR87-20.
_____, _____, _____, R. Gelderman, and R. Narem. 1987. Alfalfa response to phosphorus and potassium applications. Plant Sci, Soil Fert PR87-4.
Fixen, P.E. 1987. Fertilizer management: potassium and chloride. Proc, Central Great Plains Prof Wheat Mgt Workshop, Wichita, KS, Aug 17-20, p 115.
_____. 1987. Potassium and chloride effects on wheat yields and profitability. Better Crops, Summer 1987, p 20.
_____ and B.G. Farber. 1987. Effects of starter fertilization of corn under varying cultural and environmental conditions. Plant Sci, Soil Fert PR87-2.
_____, _____, and M. Vivekanandan. 1987. Interaction of tillage, soil test level, and P placement for corn on a Udic Boroll. Agron Abst 1987:201.
_____, _____, R.H. Gelderman, B. Lawrensen, and R. Nettleton. 1987. Residual effects of P fertilization. Plant Sci, Soil Fert PR87-1.
_____. 1988. Role of potassium chloride in no-till wheat production. Proc, 10th Annual Manitoba-North Dakota Zero-Tillage Workshop, Jamestown, ND, Jan 20-22, p 9.
_____ and B.G. Farber. 1988. Influence of soil test zinc level and phosphorus placement on yield components and branching of flax. Proc, 52nd Annual Flax Inst of the US, Fargo, ND, Jan 30-31, p 20.
_____ and D.F. Leikam. 1988. Overview of phosphorus placement. Great Plains Soil Fert Workshop Proc, Denver, CO, Mar 8-9, p 37.
_____ and _____. 1988. Concepts in phosphorus placement. Proc, SD No-Till Assn 4th ann meet, Aberdeen, Feb 24-26, p 1.
Gelderman, R. 1987. Use of soil tests to predict fertilizer nitrogen needs of corn. Plant Sci, PR87-5.
_____, B. Farber, and P. Fixen. 1987. Response of barley varieties to chloride fertilization. Plant Sci, Soil Fert PR87-17.
_____ and L. Evjen. 1987. Use of soil tests to predict fertilizer nitrogen needs of corn. Plant Sci Pamp 5, p 18.
_____ and J. Gerwing. 1987. Comparison of several soil testing laboratory fertilizer recommendations, summary report. Plant Sci, PR87-9.
_____ et al. 1987. Summary of soil test results (1983-1987). Plant Sci, PR87-13.
_____ et al. 1987. Soil testing procedures in use at South Dakota State Soil Testing Laboratory. Plant Sci Pamph 101.
_____, J.R. Gerwing, and G. Carlson. 1987. Calculation of fertilizer recommendation. Plant Sci Pamph No 1.
_____ et al. 1988. Fertilizing for grass seed production. SDAES C246.
_____ et al. 1988. Summary of soil test results (1983-1987). Plant Sci Pamph 7.
Gellner, J.L. 1987. The influence of weather on yield of spring oat cultivars. Agron Abstr, p 111.
Gerwing, J., R. Gelderman, and P. Fixen. 1988. Fertilizer recommendations guide. SDCES EC750.
Gordon, W.B. and D.H. Rickerl. 1987. Effects of tillage on nitrogen uptake and leaching. Plant Sci, Soil Fertility PR 1.
_____, _____, and J.T. Touchton. 1988. Timing and coordination of tillage operations for maximum cotton production. Int Soil Tillage Res Org 11th Int Conf Proc (2)667.
Grady, K.A., P.E. Fixen, and C.L. Lay. 1988. Effect of chloride fertilization on flax. Flax Inst of the US, Proc 52:15.
Gutormson, T.J. 1988. Separating pubescent wheatgrass (Agropyron intermedium vav. trichophorum (Link) Richt.) from intermediate wheatgrass (Agropyron intermedium (Hort) Beauv) based on lemma pubescence. AOSA Newsletter 62(1)19.

Hall, R.G., C. Stymiest, J.J. Bonnemann, H. Geise, and P.D. Evenson. 1987. 1988 variety recommendations (1987 crop performance results). SDCES EC774.
_____, J.J. Bonnemann, and P.D. Evenson. 1987. 1988 variety recommendations (1987 crop performance results). SDCES EC775.
Kephart, K.D. 1987. Too much alphabet soup: an explanation of forage nutritive quality and how it is determined. Proc SD Forage Grassl Coun 1:13.
_____ and E.K. Twidwell. 1987. South Dakota alfalfa cultivar yield test. IN J.L. Caddel (ed), Central Alfalfa Improvement Conf, 1987 Variety Tests, Oklahoma State U, Stillwater, p 131.
_____, _____, and R. Bortnem. 1988. Alfalfa cultivar yield test for South Dakota: 1987 report. SDCES EC758.
Kohl, R.A., and D.W. DeBoer. 1987. Nozzle and flow geometry effects on droplet size distributions. ASAE Paper 87-2591.
_____ and S.T. Chu. 1988. Surface cover effects on soil infiltration. ASAE Paper 88-2004.
Kooiman, A., T. Schumacher, P. Fixen, F. Cholick, and G. Buchenau. 1987. Chloride effects on plant-water relationships. Plant Sci, Soil PR87-19.
Lay, C.L., K.P. Sharma, and C.D. Dybing. 1987. Breeding for increased seed yield in soybean through lower levels of flower abortion. Agron Abstr 1987:69.
_____ and K.A. Grady. 1988. 1987 South Dakota hybrid sunflower trial. Plant Sci Bull.
Lemme, G.D., T.E. Schumacher. 1987. Erosion and tillage relationships on soil productivity of a Typic Argiustoll. SCSA 42nd ann meet abstracts, p 20.
_____. 1988. Introduction to remote sensing, book review. JAE 17:145.
_____. 1988. Soil resources of Jessen's farm research area. Plant Sci Pamph 8.
_____. 1988. Tri-state soil and water conference field guide.
Lindstrom, M.J., T.E. Schumacher, G.D. Lemme, J.P. Swan, and W.W. Nelson. 1987. Erosion-productivity influence on three northwestern corn belt Mollisols. ASAE winter meeting paper.
Malo, D.D., K.E. Cooley, P.D. Evenson, and P.E. Fixen. 1987. Variability of physical and chemical properties in selected northeastern (MLRA 102A) South Dakota soils. Agron Abstr 79:227.
_____ and M.E. Juba. 1987. South Dakota soybean production: yield and land use trends, 1961-1986. SDAES TB70.
_____, R. Hyman, M. Schmiesing, K. Smith, G. Steinley, and R. Stover. 1987. Rept No 2, Assessing general education core requirements (CORE) Part A: Core curriculum assessment methodology and Part B: SDSU freshman and sophomore ACT assessment results. IN Assessment data at South Dakota State University.
_____ and G.D. Lemme. 1988. Guidebook, 28th National Collegiate Soil Judging Contest. Plant Sci Pamph 6.
_____ and _____. 1988. Introductory soils lab manual (13th ed). Plant Sci Dept.
Marshall, R., R. Busch, F. Cholick, I. Edwards, and R. Frohberg. 1987. Agronomic performance of spring wheat near-isolines differing for daylength response. Agron Abstr:71.
McDaniel, B. 1987. Grasshoppers of South Dakota. SDAES TB89.
Millar, J.B., D.E. Hubbard, D.D. Malo, and K.F. Higgins. 1987. Hydric soil and plant correlation studies in prairie potholes of Beadle and Deuel counties, South Dakota. American Ag at the Crossroads Conf, Nov 1-3, Kansas City, MO, Soil and Water Conser Soc.
_____ and D.D. Malo. 1988. Nitrate levels and total Kjeldahl nitrogen levels of the surface water and groundwater of native prairie wetlands in Deuel County. Plant Sci, Soil Fertility PR 87-21.
_____, _____, D.E. Hubbard, and K.F. Higgins. 1988. Quality of the surface water and groundwater around prairie potholes in Deuel county, SD (draft report for contract 14-16-009-1549-6). National Ecology Research Center, USFWS.
Pollmann, R.J. 1988. South Dakota preliminary certified seed grower directory. Certification Service, SD Crop Impro Assoc, Brookings.
_____. July 1988. South Dakota seed certification standards. SD Crop Impro Assoc, Brookings.
Rickerl, D.H., and J.D. Smolik. 1987. Tillage and rotations. Annual Wheat Newsletter 34.
_____, W.B. Gordon, and J.D. Smolik. 1987. Tillage and rotation effects on soil frost. ASA Agron Abst 245.
_____. 1988. Farming systems study. Plant Sci, NE Res Sta PR (5)53.
_____, W.B. Gordon, and J.D. Smolik. 1988. Tillage and rotation influences on soil environment. Int Soil Tillage Res Org, 11th Int Conf Proc 92:833.
Schumacher, B., P. Fixen, B. Farber, R. Gelderman, and J. Gerwing. 1987. Residual effects of Cl fertilization in a corn-wheat rotation. Plant Sci, Soil Fert PR87-15.
Schumacher, W.K., and P.E. Fixen. 1987. Progressive chloride uptake and dry matter accumulation of spring wheat as influenced by residual Cl. Agron Abst 1987:217.
Schumacher, T.E., G.D. Lemme, and M.J. Lindstrom. 1987. Soil erosion and productivity on glacial till soils. Plant Sci, Soil Fert PR10.
_____, _____, and _____. 1988. Root zone limitations in a desurfaced Typic Argiustoll. SWCS abstracts.
Smolik, J.D. 1987. Editor, Annual Progress Report, NE Research Station, Watertown. Plant Sci Pamph 100.
_____. 1988. Alternative pest management strategies. Proc Sust Ag in Midwest Conf, Lincoln, NE, p 29.
_____, P.E. Fixen, D. Rickerl, and F.A. Cholick. 1988. Farming systems studies. Ann Wheat Newsletter 34:159.
Stymiest, C.E., et al. 1987 winter wheat: comments and 1987 yields. SDCES EMC883.
Twidwell, E.K. 1987. Methods of establishing forage grasses and legumes. IN Proc SD Forage and Grassland Council Winter Meeting, Watertown, p 10.
_____, M.K. Beutler, K.D. Kephart, A. Boe, and R.J. Pollmann. 1987. Guidelines for grass seed production in South Dakota. SDAES C244.
Vivekanandan, M., and P.E. Fixen. 1987. Tillage and rotation effects on soil phosphorus availability to corn. Plant Sci, Soil Fert PR87-3.
Wangemann, S.G. 1987. Chronosequences of terrace soils in western South Dakota. MS thesis, SDSU.
Wynia, R., A. Boe, J. Sommerfeldt, and D. Casper. 1987. Forage and seed yield and forage quality characteristics of Beckmannia syzigochne ecotypes from Montana and South Dakota. Proc SD Acad Sci 66:92.

Rural Sociology

Publications:

Satterlee, J.L., and D. Arwood. 1987. Social well-being: rural-urban differences. SDSU Census Data Center N/L 1(12).
_____ and _____. 1987. How vulnerable is your county to farm problems? SDSU Census Data Center N/L 2(1).
_____ and _____. 1987. 1986 estimates of the elderly population. SDSU Census Data Center N/L 2(2).
_____, _____, and S. Gandhi. 1987. Dual-earner couples in South Dakota. SDSU Census Data Center N/L 2(3).
_____, _____, and _____. 1988. America counts on agriculture. SDSU Census Data Center N/L 3(1).
_____ and _____. 1988. Local government in the U.S. and South Dakota. SDSU Census Data Center N/L 3(2).
_____, _____, and M. Haghighatian. 1988. Cancer death rates in South Dakota. SDSU Census Data Center N/L 3(3).

Station Biochemistry

Refereed articles:

Ballachey, B.E., R.G. Saacke, and D.P. Evenson. 1988. Sperm chromatin structure assay: Relationship with alternate tests of sperm quality and heterospermic performance of bulls. J Andrology 9:109.

Emerick, R.J., and D. Lu. 1987. Possible synergism of dietary phosphate and urine acidifying salts in preventing silica urolithiasis in a rat model. J Nutr 117:1603.

_____. 1987. Phosphate inhibition of protein-polysilicic acid complex formation as a factor in preventing silica urolithiasis. J Nutr 117:1924.

Evenson, D.P., and A. Fasbender. 1988. In vivo and in vitro effects of hydralazine on cellular growth, differentiation and chromatin structure. J Toxicol & Appl Pharmacol 93:339.

_____. 1988. Flow cytometry evaluation of male germ cells. IN A. Yen, (ed), Flow cytometry. CRC Press (in press).

Gledhill, B.L., D.P. Evenson, and D. Pinkel. 1988. Flow cytometry and sorting of sperm and male germ cells. IN M.R. Melamed, M. Mendelsohn, and T. Lindo (eds), Flow cytometry and sorting. Alan R. Liss, New York (in press).

Wilson, T.M., R.H. Hammerstedt, I.S. Palmer, and A. deLahunta. 1988. Porcine focal symmetrical poliomyelomalacia: experimental reproduction with oral doses of encapsulated sodium selenite. Can J Vet Res 52:83.

Other reports:

Avissar, N., J. Whitin, P.Z. Allen, D.D. Wagner, I.S. Palmer, and H.J. Cohen. 1988. Plasma selenium dependent glutathione peroxidase: cell of origin and secretion and its contribution to plasma selenium. FASEB J 2:A1440 (Abstr 6643).

Emerick, R.J. 1987. Nitrate and urea toxicities. IN D.C. Church (ed), Ruminant animal, its digestive physiology and nutrient metabolism. Prentice Hall.

_____. 1987. Urinary calculi. IN D.C. Church (ed), Ruminant animal, its digestive physiology and nutrient metabolism. Prentice Hall.

_____. 1987. Answer to silica stones. SD Farm & Home Research 37(4):10.

_____. I987. Current knowledge concerning silica urinary calculi. SDAES Beef Reports, CATTLE 87-3.

_____. 1987. Urinary calculi/waterbelly —cause and prevention. Proc Range Cow Symposium X, Cheyenne, WY.

Evenson, D.P., and B.E. Ballachey. 1988. Flow cytometry evaluation of bull sperm chromatin structure. IN Proc 12th technical conference on artificial insemination and reproduction, Milwaukee, Nat Assoc of Animal Breeders (in press).

_____ and B.E. Ballachey. 1988. Sperm chromatin structure assay usefulness for the assessment of semen quality and fertility potential. Proc 11th international congress on animal reproduction and artificial insemination. University College, Dublin, Ireland.

_____. 1988. Sperm chromatin structure assay (SCSA). IN Protocols, Ortho Diagnostic Systems, Westwood, MA (in press).

_____. 1988. Toxicological applications of male germ cells measured by flow cytometry (invited Symposium speaker). XIII Int Conf on Analytical Cytology, Breckenridge, CO.

_____. 1988. Sperm chromatin structure assay for assessment of fertility potential (invited Symposium speaker). XIII Int Conf on Analytical Cytology, Breckenridge, CO.

_____. 1988. Flow cytometry evaluation of bull sperm chromatin structure (invited Symposium speaker). 12th technical conference on artificial insemination and reproduction, Milwaukee, WI.

_____. 1988. Sperm chromatin structure assay usefulness for the assessment of semen quality and fertility potential (poster and workshop participant). 11th Inter Congress on animal reproduction and artificial insemination, Dublin, Ireland.

Lu, D. 1987. Studies of the prevention of silica urolithiasis. MS thesis, SDSU.

Owens, M., and N. Thiex. 1988. Using NIRS feed test results. SDCES Extension Extra 4002.

Tseng, S. 1988. Availability of elemental selenium to plants. MS thesis, SDSU.

Veterinary Science

Refereed articles:

Benfield, D.A. et al. 1988. Combined rotavirus and K99 Escherichia coli infection in gnotobiotic pigs. Am J Vet Res 49:330.

Tichota-Lee, J. et al. 1987. Effects of age on the sensitivity of cell cultures to Clostridium difficile toxin. Diag Microbiol Infect Dis 8:203.

Other reports:

Anderson, G.A. et al. 1987. Vaccinia virus-respiratory syncytial virus recombinants did not protect calves against bovine respiratory syncytial virus. Abstr, 68th Conf of Research Workers in Animal Disease, Chicago, IL.

Benfield, D.A. et al. 1987. Prevalence of typical and atypical rotaviruses in diarrheic pigs from conventional swine herds in the upper midwest. Abstr, 68th Conf of Research Workers in Animal Disease, Chicago, IL.

_____ et al. 1987. Monoclonal antibody to the Gottfried rotavirus which neutralizes rotavirus serotypes 3, 4, and 6. Abstr, VII Inter Congress of Virology, Edmonton, Alberta.

Francis, D.H. et al. 1987. Influence of intestinal content on the expression of K99 pili by Escherichia coli. Proc, 79th Ann Mtg, Amer Soc of Animal Science, Logan, UT.

_____ et al. 1987. Edema disease-like lesions in piglets infected with enterohemorrhagic Escherichia coli 0157:H7. Abstr, Conf of Research Workers in Animal Disease, Chicago, IL.

_____ et al. 1987. Hemorrhagic colitis in calves. Abstr, Inter Symposium and Workshop on verotoxin (Shiga-like toxin) producing Escherichia coli (VTEC) infections, Toronto, Canada.

_____. 1987. Hemorrhagic colitis of calves in the upper Midwest. Abstr, Conf of Research Workers in Animal Disease, Chicago, IL.

Hoshino, Y. et al. 1988. Antigenic structure of cross-reactive neutralization epitopes on rotavirus outer capsid glycoprotein VP7 and their involvement in heterotypic immunity. Abstr, 6th Ann Mtg, Amer Soc of Virologists, Austin, TX.

Janke, B.H. et al. 1988. Porcine ascarid larval migration as a cause of acute respiratory distress in calves. Abstr, NC Conf of Veterinary Lab Diagnosticians, U of Minnesota, St. Paul.

_____ et al. 1987. Attaching and effacing Escherichia coli infections in calves. Proc, NC Conf of Veterinary Lab Diagnosticians, Urbana, IL.

Johnson, D.D. 1987. Respiratory and systemic aspergillosis in goslings. Abstr, Western Conf of Veterinary Diagnostic Pathologists, Avian Pathology, U of Saskatchewan, Saskatoon.

Kirkbride, C.A. 1987. Causes and prevention of bovine abortion. Proc, Range Beef Cow Symposium X, Cheyenne, WY.

_____. 1988. Diagnosis and control of ovine abortion. Proc, 106th Ann Mtg, Iowa Veterinary Med Assoc, Des Moines.

_____. 1988. Infectious ovine abortion. Proc, Western Veterinary Conf, Las Vegas, NV.

Libal, M.C. 1988. Streptococcus suis associated abortion in swine: summary of bacteriologic and histologic findings. Abstr, NC Conf of Veterinary Lab Diagnosticians, Minneapolis, MN.

Mackow, E.R. et al. 1988. Characterization of homotypic and heterotypic VP7 neutralization sites of rhesus rotavirus. Abstr, 6th Ann Mtg, Amer Soc of Virologists, Austin, TX.
Nelson, J.K. et al. 1988. Prevalence of typical and atypical rotaviruses in diarrheic pigs from conventional swine herds in the upper midwest. Abstr, NC Conf of Veterinary Lab Diagnosticians, U of Minnesota, St. Paul.
White, R.D. et al. 1987. Establishment and use of a dairy calf rotaviral diarrhea challenge model for evaluating response to animal or soybean protein milk replacer. Proc, 79th Ann Mtg, Amer Soc of Animal Science, Logan, UT.
Zeman, D.H. 1987. Nutritional encephalomalacia in turkey poults. Abstr, Western Conf of Veterinary Diagnostic Pathologists, Saskatoon, Saskatchewan.
_____. 1988. Coxiella burnetii abortion in ewes. Abstr, Ann Mtg, NC Veterinary Lab Diagnosticians, St. Paul, MN.

Wildlife and Fisheries Sciences

Refereed articles:

Barkoh, A., and T.C. Modde. 1987. Feeding behavior of intensively cultured bluegill fry. Prog Fish-Cult 49:204.
Berry, C.R. 1988. Rare fish as customers of the Missouri. Pages 53-55 IN Review of the Missouri River mainstem system operation: Symposium proceedings. Missouri Basin States Assoc Div Water Resources.
_____. 1988. Effects of cold shock on Colorado squawfish larvae. Southwest Nat 33:193.
_____, K.F. Higgins, D.E. Hubbard, and D.E. Nomsen. 1988. Inventory, valuation, and restoration of prairie wetlands: ten years of research at South Dakota State University. Pages 427- 434 IN Symposium Wetlands '87. Edmonton, Alberta, Canada.
Bettross, E.A., and D.W. Willis. 1988. Seasonal patterns in sampling data for largemouth bass and bluegills in a northern Great Plains impoundment. Prairie Nat (in press).
Connelly, J.W., H.W. Browers, and R.J. Gates. 1988. Seasonal movements of sage grouse in southeastern Idaho. J Wildl Manage 52:116.
Cox, C.A., and D.W. Willis. 1987. Egg-diameter development of gizzard shad collected from a great plains reservoir. Prairie Nat 19:163.
Higgins, K.F. 1988. Reevaluation of mallard nesting on small man-made islands. Pages 112-113 IN M. A. Johnson (ed.), Proc Mallard Symp.
Howe, F.P., and L.D. Flake. 1988. Nesting ecology of mourning doves in a cold desert ecosystem. Wilson Bulletin (in press).
_____, and _____. 1988. Mourning dove movements during the reproductive season in southeastern Idaho. J Wildl Manage 52:477.
Hubbard, D.E., J.B. Miller, D.D. Malo, and K.F. Higgins. 1988. Soil-vegetation correlations in prairie potholes of Beadle and Deuel counties, South Dakota. US F&WS Biol Rep 88.
Hupp, J.W., J.T. Ratti, and L.M. Smith. 1988. Gray partridge foraging ecology in eastern South Dakota. Great Basin Nat 48:202.
Jenkins, K.J., and R.G. Wright. 1988. Resource partitioning and competition among cervids in the northern Rocky Mountains. J Appl Ecol 25:11.
_____ and _____. 1987 Simulating succession of riparian spruce forests and white-tailed deer carrying capacity in northwestern Montana. West J Appl For 2:80.
_____ and _____. 1987. Dietary niche relationships among cervids relative to winter snowpack in northwestern Montana. Can J Zool 165:1397.
Schwalbach, M.J., K.F. Higgins, and G.M. Vandel. 1988. Status, distribution, production, and factors limiting productivity of interior least terns and piping plovers along the mainstem Missouri River, South Dakota, 1986-1987. Proc ND Acad Sci 42:9.
Wertz, T.L., and L.D. Flake. 1988. Wild turkey nesting ecology in south central South Dakota. Prairie Nat 20:29.
Willis, D.W. 1988. Proposed standard weight-length equation for northern pike. NA J Fish Manage (in press).
_____. 1987. Use of gill-net data to provide a recruitment index for walleyes. NA J Fish Manage 7:591.

Other reports:

Apa, A.D., T.L. Wertz, and R.E. Erickson. 1987. National Wetlands Inventory Project: procedures and products. Proc 49th Midwest Fish Wildl Conf (abstr).
Barker, W., L. Manske, and K. Higgins. 1988. Manipulation of habitat by fire and mowing. Proc 17th Conf Prairie Grouse Tech Council (abstr).
Bauer, D.L., and D.W. Willis. 1988. Underwater weedeaters. SD Cons Dig 55(4):11.
Bauer, D.L. 1988. Effect of grass carp introduction on aquatic vegetation and existing fish populations in two small prairie lakes. MS thesis, SDSU.
Bettross, E.A. 1988. Indexed bibliography of largemouth bass literature. SD Game, Fish and Parks, Fish Prog Rept No 88-2.
Day, K.S., and L.D. Flake. 1987. Habitat selection by nesting and brooding wild turkey hens in southcentral South Dakota. Proc 49th Midwest Fish Wildl Conf (abstr).
Dieter, C.D. 1987. Habitat use by beaver along the Big Sioux River. MS thesis, SDSU.
Dillon, J.C. 1988. Production of triploid rainbow trout for evaluation in South Dakota waters. MS thesis, SDSU.
Faler, M.P. 1987. First year growth and survival in power plant evaporation and holding reservoirs. MS thesis, SDSU.
Flake, L.D., and F.P. Howe. 1988. Ecological study of mourning doves in a cold desert ecosystem on the Idaho National Engineering Laboratory. Proc 32nd Cent Mountains and Plains Section TWS (abstr).
Gilbraith, D., and C.R. Berry. 1987. Preliminary report on the status of the pallid sturgeon. SD CFWRU.
Gordon, C.C., L.D. Flake, and K.F. Higgins. 1988. Chemical characteristics of wetlands with a history of avian cholera in southcentral Nebraska. Proc 50th Midwest Fish Wildl Conf.
_____, _____, and _____. 1988. Relationship of wetland characteristics to avian cholera (Pasteurella multocida) outbreaks in the Rainwater Basin area of Nebraska. Prog Rept CFWRU.
Haworth, M., and K.F. Higgins. 1987. Nesting sites for ducks and geese. SD Cons Dig 54(6):2.
_____ and _____. 1988. Waterfowl use of man-made nesting structures in South Dakota. Proceedings of Symposium: Ecology and management of islands, peninsulas, and structures for nesting waterfowl (abstr).
_____ and _____. 1987. Waterfowl production on three types of man-made nesting structures in South Dakota wetlands. Proc 49th Midwest Fish Wildl Conf (abstr).
Higgins, K.F. 1988. Cattle grazing effects on wetland vegetation, aquatic invertebrates, and waterfowl. 41st Ann Meet Soc Range Manage (abstr).
_____, D.E. Nomsen, and W.A. Wentz. 1988. Role of the Conservation Reserve Program in relation to wildlife enhancement, wetlands, and adjacent habitats in the Northern Great Plains. USDA-USFWS Rocky Mtn For and Range Exp Sta General Tech Rept RM-158.
Hubbard, D.E. 1987. Understanding waterfowl crop damage. US F&WS and SD CES FS 836.
_____. 1988. Glaciated prairie wetland functions and values; a synthesis of literature. Rept to Natl Ecol Center.
Jenkins, K.J., K. Cooper, and E. Starkey. 1988. Ecology of elk inhabiting Crater Lake National Park and vicinity. Oregon Coop Park Studies Unit Report 88-2.

Kobriger, J., D. Vollink, M. McNeill, and K. Higgins. 1988. Prairie-chicken populations of the Sheyenne Delta. Proc 17th Conf Prairie Grouse Tech Council (abstr).
Linder, R.L. 1988. Preliminary Lake Thompson watershed management plan. SDSU.
Maher, J.P. 1987. Rainbow trout cage culture utilizing different strains, stocking densities, and feeding methods in eastern South Dakota dugout ponds. MS thesis, SDSU.
Nagendran, M. 1987. Impact of grazing systems on rodent and cottontail rabbit populations in south Texas. MS thesis, SDSU.
Nomsen, D.E. 1987. Preventing waterfowl crop damage. US F&WS and SD CES FS 837.
Schwalbach, M.J., K.F. Higgins, and G.M. Vandel. 1987. Least tern and piping plover production in South Dakota amidst multiple resource uses of the Missouri River. Proc 49th Midwest Fish Wildl Conf (abstr).
_____. 1988. Conservation of least terns and piping plovers along the Missouri River and its major western tributaries in South Dakota. MS thesis, SDSU.
_____, _____, and _____. 1988. Status, distribution, and production of interior least terns and piping plovers along the mainstem Missouri River in South Dakota. GFP Rept 88-1.
Sewell, R., K.F. Higgins, and D.E. Nomsen. 1987. Floral and faunal colonization of restored wetlands in Minnesota and South Dakota. Proc 49th Midwest Fish Wildl Conf (abstr).
Smith, B.J., H.W. Browers, K.F. Higgins, and D.E. Nomsen. 1987. Wetland drainage in association with federal highway projects in the prairie pothole region. Proc 49th Midwest Fish Wildl Conf (abstr).
Solberg, K., K.F. Higgins, and J. Koerner. 1988. Enhancing waterfowl use of wetlands by chemically creating openings. 41st Ann Meet Soc Range Manage (abstr).
_____ and _____. 1987. Enhancing waterfowl pair and nesting use and wetlands by chemically creating openings in cattail stands. Proc 49th Midwest Fish Wildl Conf (abstr).

Budget

Agricultural Experiment Station

For period ending June 30, 1988

State appropriation	$ 4,578,654
Federal appropriation	2,253,306
Federal restricted	889,853
Other restricted	4,327,503
Total	12,049,316

Director's comments

continued from page 2.

that variety when you buy seed? Research is closer to these outcomes than you may think.

Very likely, the result will be good in terms of yield and pest control and may very well be more cost efficient. Not all the chemicals will be harmful. Hopefully, many will be biodegradable in a short period of time.

There's the big unknown. I fear that we will later find that some chemicals in this new system were cleared for release when they should not have been. Remember the many chemicals that we once used in ag but which are now banned?

We must reduce, not increase, our dependency on chemicals in agriculture. We must expand our search for options immediately.

South Dakota alone can not do this kind of research, but we must do our share. I am working to make this a national initiative for all experiment stations, and I have some excellent support. I would like yours.

Whether you agree with me or not, I would appreciate your response. Our funds are limited, and they must be used for the greatest common good. We need to insert a word: the greatest **long-term** common good.

Sooner or later, farmers, ranchers, Experiment Station directors retire. The next generation takes over. Are we leaving them a future at least as good as what we started with? Let's protect our natural resources and environment from further contamination, even improve their quality, while we provide greater safety in the food we produce.

Note to readers of *Farm & Home Research:*

The Agricultural Experiment Station enters its second century with a mission that has changed little over the years: to conduct research to enhance the quality of life in South Dakota through the beneficial use and development of economic, human and natural resources.

There have been many notable successes—measurable increases in crop yields, livestock production, and expansion of ag industries. There have been successes you have never seen—the insect and disease epidemics that were headed off, for example.

The Station is a public institution that you help support through your taxes. You ought to know what's going on. Too often, however, it seems the Experiment Station has trouble telling you what it does, the goals it reaches, the problems it faces.

That's why, with this issue of *Farm & Home Research,* we begin a planned expansion of our mailing list. You may be a new reader of our quarterly, and we hope you will profit from our stories. We will continue to send you a copy as issues come off press, and later this year will ask you to fill out a survey asking for your comments and opinions.

In one year we cannot cover all the projects and all the research conducted by our scientists. If you have questions or want to read about some particular project, write to us; we'd be pleased to answer.

Editor, *Farm & Home Research*
SDSU, Box 2231
Brookings, SD 57007

Stories in *Farm & Home Research,* vol 38, no 2, were developed from news releases supplied by Jerry Leslie, ag news editor in the Department of Agricultural Communications, and by Deanna Boone, former home ec editor in Ag Communications.
Farm & Home Research is printed on campus at the SDSU Printing Laboratory.

south dakota
farm & home research
Serving the People of South Dakota through Teaching, Research, Extension

South Dakota State University
College of Agriculture and Biological Sciences
David Bryant, Dean
R.A. Moore, Director, Experiment Station
Mylo A. Hellickson, Acting Director
Cooperative Extension Service
Eugene Arnold, Director, Resident Instruction

Farm & Home Research
Mary Brashier, Editor
Duane Hanson, Designer

vol 39, no 1, 1989

Published by the Agricultural Experiment Station, South Dakota State University, Brookings, South Dakota. Sent free to any resident of South Dakota in response to a written request.

College of Agriculture and Biological Sciences
Agricultural Experiment Station
South Dakota State University
Brookings, SD 57007
R.A. Moore, Director

Penalty for Private Use, $300
Publication

Address Correction Requested

**BULK RATE
POSTAGE & FEES PAID
USDA
PERMIT NO. G269**

MARSHALL, DONALD M
AN/RNG SCIENCE CM
ASC

Contents

2 Director's comments

We test and evaluate herbicides and pesticides so that you can use them efficiently and economically. But we may be putting all our eggs in one basket; we should also be exploring non-chemical options to safeguard the environment and the quality of our foodstuffs.

3 Spring wheat: 'could have been worse'

We got an average 12 bu/A yield from our spring wheat this year, a pretty disappointing figure. Our fathers abandoned 96% of their fields and harvested 4 bu/A off the rest in the drought of '34. The reasons 1988 was better: modern varieties and better farming skills.

6 Forecast; continued 'infinite variety'

Who could fill his shoes (or overshoes)? Bill Lytle, retiring after 27 years of reading the weather as SDSU climatologist, leaves a legacy of records and a warning that "it won't get any better, not where we're sitting."

9 Dairy Center: a teamwork showcase

SDSU and the U of Minnesota, when they put their specialities together, landed a joint Dairy Research Center. Our emphasis in the project is greater food safety and increased consumer appeal of dairy products.

13 Why here?

Why would a Dairy Center come to SDSU when 80% of our milk and a good share of our dairy technology and graduates leave the state? How is it those dairy majors keep bringing home first-place trophies year after year?

14 Reservations: basis for development

The sense of kinship is so deep that Native Americans will endure extreme hardships to retain their family ties. Successful economic development always starts with demographic data. The data for the reservations show how serious the problems are.

17 The connection

Native American leaders turned to SDSU and the Ford Foundation of New York. With funding from Ford and technological assistance from SDSU, the reservations and their colleges are now developing their own human and natural resources.

19 101st annual report

We present the scientists of the Agricultural Experiment Station and their projects and publications for Fiscal Year 88